REDEFINING PUBLIC HOUSING

Distressed property rebuilt to sustainable standards

Dennis Petersen: Directing LAN’s expansion
Secret behind C&S Companies’ virtualized environment
Tapping into mine water geothermal
Healthy landscapes by design
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Seismic and wind events pose serious threats to the structural integrity and safety of structures. Building structures with a continuous load path can mean the difference between withstanding these types of natural disasters – or not.

All wood-framed buildings need to be designed to resist shearwall overturning and roof-uplift forces. For one- and two-story structures, structural connectors (straps, hurricane ties and holdowns) have been the traditional answer. With the growth in light-frame, multi-story wood structures, however, rod systems have become an increasingly popular load-restraint solution.

Simpson Strong-Tie® Strong-Rod ™ continuous rod tiedown systems are designed to restrain both lateral and uplift loads, while maintaining reasonable costs on material and labor. Our continuous rod tiedown systems include the Anchor Tiedown System for shearwall overturning restraint (Strong-Rod™ ATS) and the Uplift Restraint System for roofs (Strong-Rod™ URS).

Strong-Rod ATS for Overturning

Strong-Rod ATS solutions address the many design factors that need to be considered to ensure proper performance against shearwall overturning, such as rod elongation, wood shrinkage, construction settling, shrinkage compensating device deflection, incremental loads, cumulative tension loads, and anchorage.

Strong-Rod URS for Uplift

Strong-Rod URS solutions address the many design factors that need to be considered to ensure proper performance against roof uplift, such as rod elongation, wood shrinkage, rod-run spacing, wood top-plate design (connection to roof framing, reinforcement at splices, bending and rotation restraint), and anchorage.

Strong-Rod Systems have been extensively tested by engineers at our state-of-the-art, accredited labs. Our testing and expertise are crucial in providing customers with code-listed solutions. The Strong-Rod URS solution is code-listed in evaluation report ICC-ES ESR-1161 in accordance with AC391, while the take-up devices used in both the ATS and URS solutions are code-listed in evaluation report ICC-ES ESR-2320 in accordance with AC316.

Because no two buildings are alike, Simpson Strong-Tie offers many design methods using code-listed components and systems to help you meet your complex design challenges.

Let us help you optimize your designs. For more information about our Strong-Rod™ systems continuous rod tiedown solutions or traditional connector solutions, call (800) 999-5099 and download our new Strong-Rod™ Systems Design Guide at strongtie.com/srs.
From the publisher

MARK C. ZWEIFG
mzweig@zweiggroup.com

Planning time

With summer being in full-swing here in Arkansas, I hope each of you gets to take a little time off. It’s so difficult. We are all so busy and, even when we aren’t at work, the electronic tether of our cellphones constantly sucks us back into it.

One of my friends and clients — an incredibly successful civil engineer in his mid-40s who is the largest shareholder in the engineering firm he works in — told me he gets up at 4 a.m., is at work by 6:30 a.m., and then goes home by 8 p.m. every night. His firm is growing super fast and he is making more money than he ever has in his lifetime, but he has no time for anything outside of work.

That’s not good. It’s not healthy. He already has high blood pressure in spite of watching what he eats and regularly working out. Not only is all his time taken by his work, his health is being affected by it, too. On top of it, he is also way too dependent on it financially, which makes him doubly vulnerable. With both income and retirement based on the firm, he badly needs some diversification.

Sound familiar? I know a lot of engineers in this boat today and have been there myself — still am more than I care to admit and I’m considerably older than my civil engineer friend.

Make your plan. Know how and when you’ll get out — or at least not be dependent on your present job, so if it stops being so fun you don’t have to do it. And take care of your health. Diet and exercise can help combat stress and help you survive a serious illness if you do get one.

And meanwhile, keep your mind exercised. Read more. Get involved in teaching. Be more active in professional associations. Make friends with people who stimulate you intellectually. Be a mentor to someone who needs you.

Speaking of reading, clearly, you must know something about quality reading material. You’re reading the June issue of Civil + Structural Engineer Magazine — one that a lot of folks have worked hard to make good for you. And we’re very thankful for you and the work you do to make our world a better place! Enjoy.
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WHY YOU SHOULD SUPPORT YOUR FIRM’S GROWTH GOALS

WHEN WE ARE working with firms on strategic planning, we encourage establishing a vision around a measurable growth goal. Sometimes we get pushback in the form of suggestions of a softer goal — like becoming the “go-to firm” for whatever or similar goals that are difficult to measure.

There are several reasons for this pushback. It could be that leaders are worried about establishing a goal that could be considered a failure in the future or that the idea of growth in revenues and profits seems greedy or somehow dishonorable. Being the best and advancing design are noble endeavors, but so is growth. Growth creates opportunity. It gives people bigger jobs and bigger paychecks. It brings more jobs and money into your community. There are lots of reasons why growth is good and should be top-of-mind for all the firm’s employees.

Don’t be tempted to look at growth as simply an approach to make owners rich. That is a cynical perspective that will hold you back. Instead, look at growth as the tool to create your future opportunity to achieve anything you want. Growing firms are exciting and can provide an accelerated career path for those who want it. Growing firms spend more money on benefits and activities that connect people together and create a great place to work.

My advice to young engineers is to embrace the financial goals of the firm and show support in the form of late nights and hard work on projects. Be positive, get noticed, and get promoted!

CHAD CLINEHENS, P.E., is Zweig Group’s executive vice president. Contact him at cclinehens@zweiggroup.com.
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Visit www.bentley.com/Structural to learn more!
When my firm adopted the Core Purpose: “To improve the quality of life by demonstrating stewardship of the built and natural environment,” the senior engineers believed the designs we were creating for the built environment were always sensitive, appropriate, and consistent with their surroundings.

The young staff of engineers, planners, and landscape architects championed the stewardship element. The younger people had such a greater understanding of the world's need for stewardship. They had travelled the world and many came to the United States from faraway places. The world had not only become “flat,” but incredibly interconnected.

The young of today have technology at their fingertips to see, experience, learn, and utilize information that is being created as they watch. As this talented group has risen in the ranks, a concern for stewardship has been institutionalized as “sustainability and green.” And it is not just in the design world that this has emerged, but in the desires of builders, owners, and institutions. Even tenants of office buildings want to be in “zero emission, recyclable, self-sustaining” facilities, and they are willing to pay extra for their choice.

While this stewardship effort has been going on for a decade or longer, the concern for the diminishing natural resources of our world is now placing new emphasis on using this new knowledge that has been imparted to the young. As one of the “obsolete children” — and a senior one too — I have great confidence in the future of our world in the hands of emerging young leaders who understand the current technology and know how to utilize it in demonstrating stewardship. They will solve our air, water, transportation, and infrastructure problems while maximizing the benefits to all earth’s people.

“Adults are obsolete children.”
— DR. SEUSS

“How old would you be if you didn’t know how old you was?”
— SATCHEL PAIGE

“The old believe everything, the middle-aged suspect everything, the young know everything.”
— OSCAR WILDE

STEWARDSHIP

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David Evans, P.E., PLS, FASCE, is the founder (1976) and a member of the board of David Evans Enterprises, Inc., the holding company for David Evans and Associates (www.deainc.com), and the author of “Achieving Zero,” a book on the life of the firm. He can be contacted at david.evans@zweiggroup.com.
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STORMCON

CONFERENCE AND EXHIBITION FOCUS ON MULTIPLE ASPECTS OF SURFACE WATER QUALITY.

By Bob Drake

NOW IN ITS 14th year, StormCon, The North American Surface Water Quality Conference and Expo, will be held Aug. 2-6, 2015, in Austin, Texas. Conference organizers expect more than 2,200 attendees and 100-plus exhibitors for a full agenda of certification courses and exams, workshops, technical sessions, technology exhibits, and networking events, plus an offsite tour to a local stormwater management project.

PRE-CONFERENCE COURSES AND WORKSHOPS

On Sunday, Aug. 2, from 8:30 a.m. to 5:30 p.m., StormCon offers review and training courses for the following certifications:

- Certified Professional in Storm Water Quality (CPSWQ)
- Certified Professional in Erosion and Sediment Control (CPESC)
- Certified Erosion, Sediment, and Storm Water Inspector (CESSWI)
- Certified Municipal Separate Storm Sewer System Specialist (CMS4S)
- Certified Inspector of Sediment and Erosion Control (CISEC)

Proctored exams for each of the certifications will take place on Monday, Aug. 3, from 8:00 a.m. to 12:30 p.m. Download the conference program at www.stormcon.com/pdf/SC15_Program.pdf for information on preregistration requirements for the certification exams.

StormCon offers five pre-conference workshops on Monday, Aug. 3, from 8 a.m. to 4 p.m. There is a separate $250 fee for each workshop.

BMP Selection to Improve Your Watershed — This workshop guides program managers and engineers through the criteria necessary for selecting the most effective best management practices (BMPs) for a project, including detailed descriptions of 33 BMPs. Instructor: Stuart Stein, P.E., DWRE, president of GKY and Associates.

Construction Site SWPPP Compliance: Learning to Truly Implement a Compliant Program — Participants will learn important lessons and mistakes to avoid when correctly assessing a site for environmental compliance and determining what practices will best manage compliance. Instructor: Jennifer Hildebrand, CPESC, CPSWQ, CESSWI, CISEC, environmental compliance manager, WSB and Associates Inc.

Stormwater Pollution Modeling for LID, TMDL, and Retrofitting Analyses — This hands-on computer-based course will demonstrate how to use WinSLAMM to utilize source area stormwater controls to maintain or create a hydrologically functional landscape that mimics natural watersheds’ hydrologic functions. Instructors: John Voorhees P.E., PH, water resources engineer, AECOM; Robert Pitt, Ph.D., P.E., Emeritus Cudworth Professor of Urban Water Systems, University of Alabama; James Bachhuber, PH, Brown and Caldwell; and Caroline Burger, P.E., water resource engineer, Brown and Caldwell.

Repairing Entrenched, Incised, and Degraded Urban Streams — Techniques and Case Studies — This course will deal with some of the tools needed to design and build naturally functioning stream, river, and creek reaches, presented with extensive use of case studies. Instructors: John McCullah and Dave Derrick.

Designing and Reviewing Effective Sediment and Erosion Control Plans for Construction Sites — This advance-level course will demonstrate how applying science and engineering principles can increase the effectiveness (and identify limitations) of BMPs. Instructors: Jerald Fifield, Ph.D., and Tina Wills.

CONFERENCE PROGRAM TRACKS

Technical presentations will take place Tuesday through Thursday, Aug. 4-6, organized within six main program tracks:

- BMP Case Studies — Examples of structural and nonstructural BMPs to achieve water-quality goals (19 presentations);
- Green Infrastructure — Low-impact development (LID) techniques as well as smart growth and other green infrastructure practices (27 presentations);
- Stormwater Program Management — Funding, public education and outreach, staffing, regulatory compliance, and other elements of managing a successful program (27 presentations);
- Water-Quality Monitoring — Water-quality assessment, monitoring, and sampling techniques, and modeling practices (8 presentations);
- Industrial Stormwater Management — Industrial stormwater management and permitting, focusing on publicly and privately owned facilities covered by industrial stormwater permits or EPA’s stormwater multi-sector general permit (8 presentations); and
- Advanced Research Topics — Comparing BMP performance, evaluating testing protocols, and trends in stormwater research (22 presentations).

EXHIBITION

Opening Monday evening, Aug. 3, with a sponsored reception and continuing during the day on Tuesday and Wednesday, Aug. 4-5, more than 105 companies (listed as of press time) will showcase their latest technologies and services related to stormwater management and erosion control.

OFFSITE TOUR

On Thursday, Aug. 6, the City of Austin is hosting a tour of the Waller Creek Flood Control Tunnel Project (www.austintexas.gov/department/waller-creek). According to the project website, “The mile-long tunnel will capture and redirect flood waters south of 12th Street and safely carry them to an outlet lagoon on the shores of Lady Bird Lake. In doing so, the tunnel will take nearly 28 acres of downtown land out of the 100-year floodplain and create an environment suitable for redevelopment. The project will also include amenities such as a new public boathouse and stream bank restoration.”

The tunnel, approximately 5,600 feet long, 26 feet in diameter, and 70 feet underground, is expected to be in service by mid-2015. Tour registration is $65.

Information for this article is from the conference website (www.stormcon.com) and program, which is available for download at www.stormcon.com/pdf/SC15_Program.pdf.
**JUNE**

**MUNICIPAL WET WEATHER STORMWATER CONFERENCE**
**JUNE 15-16, 2015, ATLANTA**
Presentation will inform and educate MS4 operators, consultants, contractors and others practicing in the discipline of stormwater management, stormwater quality, and erosion and sediment control.
www.ieca.org/ms4

**BECOMING A BETTER PROJECT MANAGER**
**JUNE 16, 2015, SAN FRANCISCO**
This course provides a fundamental understanding and some specific tools that new and aspiring project managers can use to be more effective in an A/E/P or environmental firm.
https://zweiggroup.com/seminars/better_pm/registration.php

**BECOMING A BETTER SELLER**
**JUNE 18, 2015, MADISON, WIS.**
**OCT. 8, 2015, CHARLOTTE, N.C.**
A one-day seminar specifically developed to help design and technical professionals in architecture, engineering, planning, and environmental firms become more comfortable dealing with clients and promoting the firm and its services.
https://zweiggroup.com/seminars/better_seller

**5TH INTERNATIONAL SYMPOSIUM ON HIGHWAY GEOMETRIC DESIGN**
**JUNE 22-24, 2015, VANCOUVER, BRITISH COLUMBIA**
The Symposium consists of podium sessions on geometric design issues throughout the world, together with country reports featuring recent developments in road design, policy and practices, technical software demos, design and research products, and technical tours of local highway design and construction practices.
www.ishgd2015.net

**PCBC CONFERENCE**
**JUNE 24-25, 2015, SAN DIEGO**
PCBC provides a forum for members of the homebuilding industry and their manufacturing partners to connect. Education tracks include Land, Capital, Multifamily trends, Marketing, Design, Business/operations, and Energy/green.
www.pcbc.com

**JULY**

**PUBLIC-PRIVATE PARTNERSHIPS IN TRANSPORTATION**
**JULY 15-17, 2015, WASHINGTON, D.C.**
The ARTBA P3 Conference provides updates and presentations on market opportunities from state transportation departments, discussions on alternative technical concepts, legal issues, risk allocation, and more.
www.artbap3.org

**ESRI AEC SUMMIT**
**JULY 18-21, 2015, SAN DIEGO**
The summit helps architecture, engineering, and construction professionals inform their decisions and designs with geospatial intelligence.
www.esri.com/events/aecsummit

**ESRI USER CONFERENCE**
**JULY 20-24, 2015, SAN DIEGO**
This annual conference offers more than 990 technical workshops, demo presentations, and papers by Esri users globally. In addition, meet Esri’s software developers, technical and training staff, and customer service support teams.
www.esri.com/events/user-conference

**AUGUST**

**STORMCON**
**AUG. 2-6, 2015, AUSTIN, TEXAS**
The North American Surface Water Quality Conference and Expo offers certification courses and exams, workshops, technical sessions, technology exhibits, and networking events, plus an offsite tour to a local stormwater management project.
www.stormcon.com

**FEDERAL PROJECT DELIVERY SYMPOSIUM**
**AUG. 18-20, 2015, WASHINGTON, D.C.**
The Design-Build Institute of America and Society for American Military Engineers jointly hosted event will explore best practices and lessons learned, with perspectives provided from the federal agency/owner, designers, builders, and other members of the project delivery teams.
www.designbuildfederal.com

**BUILD BUSINESS**
**AUG. 19-21, 2015, LOS ANGELES**
The Society for Marketing Professional Services’ annual conference brings together AEC marketers, business developers, principals, and firm owners for keynote presentations, educational tracks, client panels, and breakout sessions.
www.smpsbuildbusiness.org

**APWA CONGRESS**
**AUG. 30-SEPT. 2, 2015, PHOENIX**
The American Public Works Association conference features more than 400 exhibits of the newest equipment and technologies and more than 125 education sessions covering the entire gamut of public works.
www.apwa.net/Congress
SEPTEMBER

GIS IN TRANSIT
SEPT. 1-3, 2015, WASHINGTON, D.C.
Presented jointly by the National Center for Transit Research, Urban and Regional Information Systems Association, and the Transportation Research Board, this 9th national conference showcases how agencies of all sizes and budgets are managing GIS data and improving transit service.
www.urisa.org/education-events/gis-in-transit-conference

HOT FIRM AND A/E INDUSTRY AWARDS CONFERENCE
SEPT. 3-4, 2015, BOSTON
Conference agenda includes topics on technology, leadership challenges, business planning, marketing methods, recruiting and retention, and growth strategies. An awards luncheon celebrates the Zweig Group 2015 Marketing Excellence Award winners, and in a black-tie awards banquet and ceremony, awards will be presented to firms on the 2015 Hot Firm List, the 2015 Best Firms To Work For ranking, and the Jerry Allen Courage in Leadership Award winner.
https://zweiggroup.com/conference

STORMWATER CONGRESS
SEPT. 26-30, 2015, CHICAGO
The 2015 Stormwater Congress is a specialized educational opportunity included in the WEFTEC 2015 program. More than 30 stormwater technical sessions and workshops include Regulations and policies; Flood impacts and mitigation; Benefits of green infrastructure; Stormwater and transportation systems; Operations and maintenance; Research in stormwater; Stormwater financing and funding strategies, and more.
www.weftec.org/stormwatercongress

WEFTEC
SEPT. 26-30, 2015, CHICAGO
The Water Environment Federation’s Annual Technical Exhibition and Conference is the largest conference of its kind in North America. A wide range of topics and focus areas allow attendees to design their own learning experience while earning up to 35 contact hours for continuing education units and 9 professional development hours.
www.weftec.org

Send information about upcoming conferences, seminars, and exhibitions relevant to civil and structural engineering to Bob Drake at bdrake@zweiggroup.com.
CLIENT SATISFACTION SURVEY
By Bernie Siben, CPSM, The Siben Consult, LLC

SOMETIMES IT IS difficult to know with any certainty what your clients think of your work. If you’ve done a good job for a particular client, you might not know for sure until they call you with the next project, or a new prospect calls you based on that client’s recommendation. If you’ve done a less than satisfactory job, you may not ever hear from that client again, and you may never know why.

So, it is important to look for ways to engage your clients in conversations that let you know if there is an improvement that has to be made. Many project managers conduct what they believe are quick client satisfaction surveys in their own heads based on achievement of project scope, schedule, and budget. But if you leave the client out of the satisfaction survey, what you get is a client satisFICTION survey!

PROJECT PROFITABILITY: HOW MANY PROJECT MANAGERS DO YOU NEED?
By Howard Birnberg, Association for Project Managers

SURVEYS ATTEMPTING TO quantify the number of project managers based on the number of projects or similar ratios often are of little use. For a number of reasons — including staff experience, quality of support, project complexity and timing, client abilities, and others — there is no fixed answer. Well-managed organizations are always training younger staff in the principles and applications of project management so they are available to meet the needs of an ever-changing workload. In smaller organizations with limited staff, most technical employees should be given basic project management training.

Find these web-exclusive articles with the JUNE 2015 issue of CIVIL + STRUCTURAL ENGINEER at www.cenews.com.
AWARDS, PROMOTIONS, AND NEW HIRES

Charles Hymes, P.E., was named a senior technical manager in the Orlando office of Parsons Brinckerhoff. He will manage and provide technical support for transit and rail projects throughout the country. Beverly Ingram, who was named a supervising planner in Parsons Brinckerhoff’s Baltimore office, will join the firm’s team providing program management support to the Anne Arundel County Department of Public Works for its watershed capital improvement program. Robert Morris, P.E., named a senior supervisory engineer, will manage Parsons Brinckerhoff’s civil engineering team in its Herndon, Va., office and provide project and task management for various projects in Virginia and throughout the Southeast.

Don Williams, P.E., joined Gresham, Smith and Partners (GS&P) as a principal-in-charge and senior civil engineer in the Land Planning market, where he will be involved with business development and project leadership. Kristi Schnell, P.E., a senior associate and senior engineer in GS&P’s Water Resources market, received the Young Engineer of the Year award from the Tennessee Society of Professional Engineers Nashville chapter. The award recognizes the region’s most outstanding engineer based on professional achievements, industry leadership, and civic involvement. The firm also announced that J. Kenneth Roseman, P.E., joined GS&P’s Louisville, Ky., office as a senior water resources engineer. At GS&P, Roseman will focus on project management, client service, and business development throughout the region.

Jess Yoder, P.E., joined AECOM as a vice president based in San Francisco and will serve as director of program management/construction management delivery and quality assurance in the company’s Americas water business line. Allison G. Williams, FAIA, a vice president and the design director for the San Francisco Metro Regional practice of AECOM, was recognized as a 2015 Distinguished Alumni of The College of Environmental Design at the University of California, Berkeley. She is a member of the Harvard Graduate School of Design Visiting Committee for Harvard’s Board of Overseers, serves on the board of directors for the San Francisco Planning and Urban Research Association, and was honored in 2014 as one of the Bay Area Business Times Most Influential Women.
Fargo, N.D.-based engineering design firm Ulteig named Doug Jaeger to the position of CEO. He succeeds Eric Michel who will step down from the company’s board of directors but will remain an advisor to the company.

David Saladino, P.E., joined VHB as director of transportation engineering in Vermont, where he will oversee transportation planning and design for roadway, bike/pedestrian, and traffic engineering projects across the state.

Neel-Schaffer, Inc., announced that Roy Thomas, P.E., and Ryan Waldron, P.E., joined the firm’s Mandeville, La., and New Orleans offices, respectively, bolstering the firm’s expertise in water, wastewater, hydraulics and hydrology services, and coastal engineering. Also at Neel-Schaffer, Sidney Kelly was named Young Engineer of the Year for 2015 by the Mississippi Engineering Society.

Dennis K. Johnson was named a principal at Raths, Raths & Johnson, Inc. (RRJ), a national engineering, architecture, and forensics consulting firm located in Willowbrook, Ill. He has more than 40 years of experience that includes investigation, repair design, and performance testing of exterior wall and fenestration systems and glazing materials. As a principal, Johnson will be responsible for project management, thought leadership, business development, and quality assurance across RRJ’s range of expert consulting services.

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Keith Golden, P.E., joined ARCADIS as vice president and market sector leader to help transportation agencies develop programs and methodologies to improve the quality of mobility in the Southeast region of the United States. He has 28 years of experience with the Georgia Department of Transportation. ARCADIS also hired Adrien Litton as a senior analyst in the company's Infrastructure Planning & Management group, bolstering the firm’s GIS capabilities. Based in the firm’s Irvine, Calif., office, Litton will work with state and local transportation departments to improve the planning process for large-scale infrastructure development, emergency response planning, and utility management. Thomas Franz, M.Sc., P.Geo., was appointed president of newly consolidated ARCADIS Canada Inc. As part of this move, the approximately 250 ARCADIS Canada, ARCADIS Franz, and ARCADIS SENES/DCS staff across six provinces are now part of one unified ARCADIS Canada Inc., which will operate in parallel with ARCADIS U.S. within ARCADIS North America. Previously, Franz led ARCADIS Franz Environmental as CEO.
DENNIS PETERSEN: LEADING THE WAY
A STEADY, EXPERIENCED HAND DIRECTS LAN’S CONTINUOUS EXPANSION.

By Maureen Foody

ONE CAN LEARN many essential lessons while leading a company through the good times and the rough times. Dennis W. Petersen, P.E., president of Lockwood, Andrews & Newnam, Inc. (LAN) has weathered many of both during his years leading the firm. His optimistic outlook and years of experience help drive LAN’s continuing expansion.

“I wish it were more of a visionary tale, but I was just doing what I thought needed to be done,” Petersen said, recounting three decades spent working at LAN. “You have to try and find the optimal tipping point in a decision,” said Petersen of how he has made decisions over the years. “We’re always looking for the details as engineers, but you have to trust your gut at the same time.”
Growing up on a farm in rural Texas, Petersen developed an inherent understanding of why things did or did not work — out of necessity. He recounted how there was always work, so you had to rely on yourself. Using this keen ability, he began working in the oil field services industry in 1970 but soon noticed that almost everyone he was working for was an engineer.

“My boss and my boss’ boss all held engineering degrees, so I looked at them to see what I had to do to keep moving forward with my own career,” Petersen said.

He enrolled in night classes, initially at Houston Community College, while still working. He later enrolled at the University of Houston, where he completed his bachelors of science in industrial engineering and also his MBA in finance.

Through those years of persisting through night classes and working a full-time job, Petersen knew he wanted to stay in Texas. So in 1980 when LAN reached out to schedule an interview with him, he gladly took the position that was offered, starting out as a project engineer.

“This was very early on at LAN, I was hooked. They had an exciting and wide array of projects going on,” said Petersen. He was able to consult on a variety of projects from all levels within oil field services, aircraft, and environmental markets. “I was never bored. Our goal as a company has always been to be the best, not the biggest. In essence, we’re a little bit more specialized, but we accomplish our goals.”

This knowledge and trust is what keeps clients coming back to LAN, Petersen said. The firm has been profitable every year since 1998, while expanding into new markets, including infrastructure, transit, and transportation. Even during the recent recession, the company decided to push into markets in Florida and California that were expanding.

“Diversification was one of the key elements I wanted to implement,” Petersen said. “If you can remain a long, steady, and continuous presence, you’ll gain positions and be able to expand your capabilities.”

As the firm expanded into more water, wastewater, transit, and transportation markets, it landed a number of wins, including the Lake Huron water intake project for Kargnondi Water Authority in Michigan and the VTA/BART Silicon Valley Berryessa Extension near San Jose, Calif. LAN also has worked on an impressive variety of major projects in recent years, including the Houston Surface Water Transmission Program, Dallas Area Rapid Transit Light Rail, Houston Hobby Airport Redevelopment, San Antonio Aquifer Storage and Recovery Pipeline, and a 75-mile corridor study for I-69.

Petersen had to learn how to delegate as LAN’s growth continued and his responsibilities increased over the years from project engineer to manager to program manager then vice president and his current role as president. In March 2014, Petersen added to his responsibilities when he was appointed president of LEO A DALY, the parent company of LAN and an internationally renowned architecture, engineering, and interior design firm. Petersen now spearheads both LEO A DALY and LAN brands.
“The thought of not being able to do it all hurts as an engineer sometimes, but you have to effectively delegate,” Petersen said. “It helps to think of it [in terms of]: How do you get things done when you can’t? Leadership is about getting things done.”

Petersen also mentioned the importance of timing when it comes to success. “It takes both talent and listening,” he said. “You have to know when the time is right by keeping your ears open.”

Petersen advised those currently seeking their role in the engineering community to recognize the world outside their cube. “You need to figure out where and how you fit into your world process,” he said. “Listen, but remain adaptable and persistent. At LAN, I personally moved through three different changes of industry as the markets changed, which is a challenge.”

But, according to Petersen, it’s through those challenges that you learn what you’re truly capable of accomplishing. “One of the most consistent things in the industry is change,” he said. “You’ll always be looking at different things, so you have to know what you can do.”

Looking forward, Petersen cited the challenge of where engineers currently fit in the construction process, how, and why. “This can be a profitable act but we have to add value to a project,” he said. “Figuring that out is key.”

“Every place we work has its own idiosyncrasies — from local legal systems to the fun challenges you thrive on as an engineer — but it’s always different,” he said. “You truly are never bored as there are always so many different things that make the job worthwhile.”

Early on, when first experiencing the varieties in the profession, Petersen learned a valuable lesson about diligence on his first federal project. “Patience is always a key tool,” he said.

After almost 20 years at the helm as president of the company, Petersen is proud of the work he has done with the help of every person at LAN as they’ve been able to adapt and change in order to remain competitive and have a bright future on the horizon.

With more than 31 offices within the company, downtime is elusive for Petersen as he regularly visits the company’s branches to remain active and aware of all the aspects at work. Petersen joked that “home is just where your mail shows up,” but he really does enjoy spending time at home with his wife Beverly, married for 39 years. With two daughters and now two grandchildren, Petersen greatly enjoys his role as a grandfather.

When home, Petersen still enjoys spending time on his farm. “Something always needs to be fixed or improved; it’s a great challenge,” he said. “You see results very clearly as you see where your tractor has [worked] that day. That’s not something you get to see in your job very often as those sort of things take time to develop. So it’s nice to have something that is instant gratification.”

Like many leaders in the AEC industry, Petersen advocates public service. “You need to be part of the community you’re in,” he said. Petersen makes time for both community events and political pursuits and encourages those starting out to try the same as help to prepare for the real world.

Petersen also contributes time to the University of Houston, Cullen College of Engineering, serving as a mentor to help guide graduates preparing for the workforce and also to help with its leadership board to gain recognition for the college. The college recently recognized Petersen as a Distinguished Alumni, which was especially meaningful to him because it reached across all disciplines.

It’s easy to understand the accolades, with such an impressive list of feats as both an engineer and the leader of a company moving forward into new territories with its known commitment to quality.

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A COUPLE OF YEARS ago, we in the IT department at C&S Companies found ourselves in a bit of a jam when we realized that the two Dell EqualLogic arrays we were using had reached “end of life” in the sense that Dell would no longer support them. That forced us to take a step back and evaluate how we could improve our storage infrastructure to meet current and future needs.

The first step was to figure out what we truly needed in a system. Although we have a staff of more than 400, offices nationwide, and work on projects from local, state, and federal government, to industry and manufacturing, and private business, we consider ourselves fairly small. It was this “small” mentality that made us not want to purchase separate disk arrays for our VMware server and VMware VDI environments. It was important that we could support a mixed workload on the SAN.

In addition, we needed a product that could grow with our business. We also felt strongly about finding a SAN with an active/active controller configuration. Our previous EqualLogic solution had eight network adapters on the 6500 and six on the 5500, but only half of them were available for use at any given time.

We decided the best way to meet our needs would be to migrate our CAD data to the cloud utilizing a caching solution from Panzura, while evaluating SAN solutions for the majority of our applications. We were hoping to migrate to 10 GB iSCSI at the same time; budgets being the way they are, we wanted to ensure that we could utilize either 1 GB or 10 GB iSCSI.

Next came the evaluation of solutions on the market to determine which one would meet as many of our criteria as possible (if not all). After careful evaluation, we chose the NexGen N5-300 Hybrid Flash Array, which met all of our requirements and then some. We made the official switch to the new system over the 2014 Christmas/2015 New Year’s holiday.

As a result, we achieved our goal of one array for the mixed workload, running both the virtual server and VDI environments on the NexGen N5. We had virtualized our payroll, accounting, Active Directory, Microsoft Exchange, Microsoft SQL Server, Microsoft SharePoint, CAD licensing servers, and archive data servers. We began a VDI implementation in 2013 but decided to wait to deploy it until we obtained the new SAN. With the SAN and vSphere 5.5 we were able to achieve 99 percent virtualization. Utilizing vSphere 5.5 with View 5.3 for our VDI environment we plan to increase its utilization during the next year. And we saved space; we are able to support both our virtual server and VDI environments in 3U of rack space — less than half of our previous 8U configuration.

Performance was a big selling point for the NexGen implementation. We like the performance of NexGen’s PCIe flash implementation versus other systems that use SSD behind legacy storage controllers. The concept of PCIe flash hybrid storage was introduced to us at VMworld in 2013 and was something that we looked for during the planning stages — not knowing if we could afford it. With the NexGen array, C&S has decreased write latency 400 percent from 12.9 ms to 3 ms, and reduced average disk queue depth from 5.8 to 0.23.

The increased performance and mixed workload support of the NexGen N5, combined with our transition to 10 GB iSCSI, gave our IT team exactly what we needed to move our VDI implementation into production. To provide an example of the difference we’ve experienced, we have a large gold image — 100 GB — and had previously experienced significant delays in propagating the gold image to virtual desktops. With the upgraded infrastructure, the VDI recompose process dropped from more than 90 minutes to roughly 20 minutes.

Pure performance aside, with the mixed workload, performance prioritization is also a critical piece. With NexGen’s Quality of Service (QoS) feature, we’re able to look at what’s important to the business and prioritize all of our data accordingly. For example, both VDI and Exchange use a mission-critical policy setting, ensuring they get the highest priority for performance, while the archive server has been set to low priority. Payroll is in the middle, as business critical.
Following are brief explanations of many of the acronyms and terms used in this article.

3U and 8U — A rack unit, U or RU, as a unit of measure describes the height of electronic equipment designed to mount in a 19-inch rack or a 23-inch rack. One rack unit is 1.75 inches (44.45 mm) high. The size of a piece of rack-mounted equipment is frequently described as a number in “U.” For example, one rack unit is often referred to as “1U,” two rack units as “2U,” and so on — in this article, 3U and 8U.

Arrays — Hardware element that contains a large group of hard disk drives (HDDs). It may contain several disk drive trays and has an architecture that improves speed and increases data protection. The system is run via a storage controller, which coordinates activity within the unit.

Disk queue depth — The number of pending input/output (I/O) requests for a volume.

Gold image — A template for a virtual machine, virtual desktop, server, or hard disk drive. May also be referred to as a clone image or master image.

iSCSI — Internet Small Computer System Interface. An Internet Protocol (IP)-based storage networking standard for linking data storage facilities. By carrying SCSI commands over IP networks, iSCSI is used to facilitate data transfers over intranets and to manage storage over long distances. iSCSI can be used to transmit data over local area networks (LANs), wide area networks (WANs), or the Internet, and can enable location-independent data storage and retrieval.

LUNs — Logical unit numbers. A number used to identify a logical unit, which is a device addressed by the SCSI protocol or Storage Area Network protocols, which encapsulate SCSI, such as Fibre Channel or iSCSI.

PCIe flash implementation — PCIe, which stands for Peripheral Component Interconnect Express, is a high-speed expansion card format that connects a computer with its attached peripherals. PCIe has a point-to-point architecture. This means that each device connects to the host with its own serial link and does not have to share a bus. In general, PCIe-based flash has better performance than server-based SATA, SAS, or Fibre Channel (FC) flash because of the direct connections.

SAN — Storage area network. An architecture used to remotely attach computer storage. SAN devices connect to a number of servers using fibre channel. Most SAN systems use the small computer system interface protocol. An add-on card must be installed in each computer that will be connected to a SAN device. A SAN is seen by a connected server as a local drive. Since the SAN serves data only as raw disk blocks, the server itself must provide file management.

SSD — Solid-state drive. A data storage device that uses integrated circuit assemblies as memory to store data persistently. Most SSDs use NAND-based flash memory, which retains data without power.

VAAI — vStorage API for Array Integration. An application program interface (API) framework from VMware that enables certain storage tasks, such as thin provisioning, to be offloaded from the VMware server virtualization hardware to the storage array.

VDI — Virtual desktop infrastructure. A desktop-oriented service that hosts user desktop environments on remote servers and/or blade PCs.

Virtual server — A server, usually a Web server, that shares computer resources with other virtual servers. In this context, the virtual part simply means that it is not a dedicated server — that is, the entire computer is not dedicated to running the server software.

VMware — A U.S. software company that provides cloud and virtualization software and services.

vSphere — VMware’s cloud computing virtualization operating system.

Write latency — Time interval or delay when a system component is waiting for another system component to write something.

Given the VMware-centric nature of our environment, we have also taken advantage of the vSphere plug-in available from NexGen. The plug-in allows us to easily create LUNs and gives us the ability to have a window into the NexGen environment right from the vSphere console. In addition, I was pleased to see NexGen on the VMware hardware compatibility list (HCL), as well as support for VAAI.

One feature NexGen offered that we knew we needed once we became familiar with it is the pattern matching algorithm for saving I/O from disk to cache and vice versa. We had evaluated a competing solution that had less disk space but used compression to make up the difference; we didn’t like the way that worked. We didn’t want to purchase an array and then have to go back to the well if it turned out that what we migrated in didn’t compress at the ratios expected; the penalties of compression/dedupe take away from the performance.

Finally, the cost of the NexGen N5 was competitive. We were looking at the Ferrari of hybrid flash arrays and thought the price would match, but we were pleasantly surprised to find the price was lower than the others we were considering.

Every firm has its own unique needs, wants, and priorities. For us, NexGen provided the solution that fulfilled all of those things, and will continue to do so for the next several years.

JEFF MCGOWAN is senior network administrator with C&S Companies (www.cscos.com), a Syracuse, N.Y.-based firm providing engineering, architecture, planning, environmental, and construction services.

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SAVING PUBLIC DOLLARS

HILLSBOROUGH COUNTY’S TWO-PHASE PROCESS CUTS COSTS, IMPROVES OPERATIONS, AND INCREASES SERVICE.

By W. Roger Cox, P.E., and Jeff Thurman, C.P.M.

Creating Long-Term efficiencies and sustainability is a huge focus of today’s government sector. Every day, the charge of public works leaders is to do more with less. Further, technology, if used correctly, can be an effective tool for organizing work and cutting costs.

In late 2010 and continuing into 2014, Hillsborough County, Fla., embarked on a two-phase process of cultural change and process improvement. The goals were to establish a baseline of current operations, develop and identify opportunities that would improve operations, and formulate recommendations that would lead to improvements and implementation strategies to ultimately enhance work methods and management efforts. The review was not an audit but an internal effort to improve, consistent with their mission statement and guiding principles. The initial phase was a top-to-bottom review to determine the most effective and efficient way to deliver high-quality responsive service. While the review revealed that the county was performing at a high level in many areas, several opportunities were identified for improvement.

Hillsborough County is located on the west coast of Florida, southwest of Orlando. The county has 1,051 square miles of land and an additional 215 square miles of water. With approximately 158 miles of shoreline on Tampa Bay, the county’s coast makes it the largest bay in Florida, which also opens to the Gulf of Mexico. The population has grown consistently and is expected to grow by 1.58 million by 2030. The county draws more than 15 million tourists annually, increasing the county’s traffic and infrastructure use and placing an extra emphasis on repair and maintenance.

The Transportation Maintenance Division (TMD) maintains more than 3,300 centerline miles of roadway. The road miles are the state’s third largest, and Hillsborough has more road miles than Hawaii, Road Island, New Jersey, Vermont, and Massachusetts DOTs combined.

In addition to the pavement features, the TMD is responsible for maintaining approximately 2,500 miles of sidewalks, 119,000 sidewalk ramps, 3,000 miles of curb, 3,500 miles of shoulder, 1,200 miles of...
of culverts, 1,200 miles of ditches, 7,000 stormwater manholes and junction boxes, 2,400 control structures, 72,000 end treatments, 14,000 headwalls, and 2,200 detention/retention ponds. It also has responsibility for maintenance of 251 bridges. The county has a total asset value of more than $10 billion.

The path of evaluation was to follow the four phases of ideal maintenance management, including planning, organizing, scheduling, and controlling. The result of the evaluations was a complete outline of the current state (baseline), identification of 86 opportunities for improvement, and 68 key recommendations that comprised all four phases of the ideal maintenance management agency. The review’s final report served as a game plan to achieve the goals of an efficient and effective organization. After evaluation and development of the game plan, it was time to implement its recommendations, charting a path to improvement.

Initially, Hillsborough County had to re-establish and define the maintenance and repair activities they perform and determine which assets they were responsible for. This first step used a combination of the institutional knowledge of employees, GIS technology, and other manual and automated databases. They utilized ESRI ArcGIS to create maps of assets, boundaries, and other features. Managers, supervisors, and field staff reviewed the maps for accuracy and completeness, using technology as a tool to assist in this process but using staff knowledge to assist (not direct) the effort.
The final report of the review process also included, as a recommendation, creation of an overall planning section designated to work with all of the field units and acquisition of a new computerized maintenance management system (CMMS) to replace the existing system. The purpose of the planning section was to provide guidance, oversight, and accountability for the work performed by the county’s field units. This ensured that the work outlined as part of the department’s annual plan was fully transparent to the crews and management at the field units, as well as providing user support and data integrity and process checks. The county selected MaintStar version 12.0.104 CMMS, as outlined in the review process, to be able to integrate with the GIS, allowing for spatial data and relationships to be fully understood and used to create viable maintenance plans.

Further, using technology as a tool for improving the planning, organizing, and scheduling of work, the TMD utilized a combination of technology and manual processes to develop maintenance routines to address the goal of planning at least 80 percent of its work and concentrating on the “significant few” that have the largest impact on the organization. From its initial effort of defining activities with resource needs, levels of effort, and knowing its responsibilities, the TMD was able to develop routines for most of its work activities. They now know the what, how, where, and when of their maintenance work.

For example, with the activities of right-of-way mowing, tree trimming, sidewalk repair, and ditch cleaning, TMD utilized GIS to establish routines and create operational blocks for efficient execution by maintenance resources. The top activities were mapped and scoped to quantify their efforts. Most operational blocks were based on the amount of work that can be produced in a two-week time period, which correlates...
to the time period established for the short-term scheduling process that has been established. With known quantities and established average daily productions, they are able to calculate productions and levels of service for each activity. Through this, the TMD is able to measure the effectiveness of field crews and create accountability.

For mowing, operational blocks were established that have the acreage to be mowed in a specific time period. For tree trimming, they have operational blocks with specific linear feet of trees to be trimmed. Figure 1 illustrates the developed operational blocks for right-of-way mowing. For canals they measure the linear feet of canals to be cleaned. The division has also developed operational blocks for hand, slope, and canal mowing.

As a result of establishing operational blocks and routines for several of maintenance activities, levels of service have increased by doing more work with the same or less resources. For example, right-of-way mowing cycles have increased more than 48 percent, with some units doubling their turns as compared with before implementation of operational blocks. They also developed a routine for canal cleaning that will allow the canal system to be maintained on five-year cycles; previously, portions of the system had no maintenance recorded since maintenance records have been kept.

Other technologies were also established and are currently being utilized to accomplish recommendations from the game plan and achieve their goals. For example, as the result of the Service Unit’s maintenance yards being geographically too far apart to meet bi-weekly, remote Web-based meeting technology such as GoToMeeting is now being used to review previous bi-weekly schedules, complete audit work, establish work schedules, and increase communication and cooperation between groups. As a result, the Service Units can present schedules, check with field operations for final adjustments to schedules and work, as well as monitor overall progress. Units can coordinate equipment needs and potentially insert work into the schedule. Long-term projects can also be discussed, which has led to transparency and has given all employees a feeling of ownership and involvement in the operations. Meetings can be recorded for playback by absent staff members or can be used for accountability.

Results
These efforts have increased service to the public, reduced complaints, and reduced work backlog, as well as saved more than $1 million through improved efficiencies and improved business processes using fewer resources. Through implementation of specific recommendations, systems and processes were put into place to allow for accountability and monitoring of resources compared with established standards. To date, the TMD has realized an approximate 15 percent increase in productivity through developing and re-engineering processes related to planning, organizing, and controlling the way they do business — which means 15 percent more work with the same resources being used. Future presentations to the board of Hillsborough County Commissioners related to budgetary and service level changes can now be better addressed due to improved planning and organizing capabilities. Further, through this process and the
leadership of Systems Planning, they have shown how they can entrust Hillsborough County to manage its limited resources and protect the public’s investment in public infrastructure.

The division identified, and now focuses on, its primary activities by using the Pareto’s Law concept, where 20 percent of its activities accounted for 80 percent of the budget. This resulted in vegetative control activities — tree trimming, roadside mowing (Figure 2), and ditch cleaning — being the largest work effort. The emphasis is to work on the activities that make the most impact and resist working on activities that add little value. As an example, Hillsborough County developed and implemented several tasks into routine maintenance cycles, each based on several factors, including assets that they are responsible for, available resources, and the levels of service determined for each activity.

While applying this methodology to one of the highest requested activities, they developed and implemented mowing blocks. As a result, mowing cycles have increased overall by 25 percent system wide, with some units doubling mowing frequencies. Tree trimming and removals are another area of considerable success. After identifying 100 percent of the needs, routines were developed and resources were deployed. TMD is projected to complete a tree trimming cycle every three years, thus increasing safety for the community and reducing the need for customers to call for requested service.

With development and execution of further routines in other activities, it is projected that TMD will realize similar efficiencies in service delivery to the customers of Hillsborough County. Through better planning, organizing, scheduling, and controlling processes and methods, they reduced backlog work orders by 57 percent and projected to reduce them by an additional 30 percent in the near future, reducing customer requests significantly. This includes eliminating all tree trimming requests in the county.

Lessons learned and anticipated results
For this type of review to be successful, elements of success are required. Buy-in to the process must occur on all levels prior to commencement. Senior management has to be committed to the entire process and must see it through every step. The right person must be chosen to lead the implementation of recommendations, ideally an employee who is and can be committed to the entire process from start to finish. Besides senior management’s commitment, communication must occur at all levels and phases to obtain optimal results. Real data must be used and confirmed so that outcomes are accurate and quantifiable.

Anticipated results include that feedback to all levels of the organization will be provided and evaluated. Future developed processes and implementation of new technologies must match the organization’s identified needs, further contributing to the goal of continuous improvement. All work will be systemized so that there will be increased quantifiable efficiency. Lastly, employees will feel involved and empowered, resulting in a feeling of transparency, ownership, pride, and job satisfaction.

Conclusion
The game plan was about establishing business processes for overall improvement. Hillsborough County reduced its budget, increased service, and lowered backlog by developing a plan. Second to developing a plan is the critical element of employee participation, ownership, and support for making improvements to the system. The success of this review has been documented in the observations of others in a performance audit that was conducted in December 2012 by an outside, independent auditing firm.

And according to an October 2010 report, “the department is transforming field operations in a positive way, and plans exist to expand this success… By extrapolating the recommendations to all functional areas, the department will be able to considerably improve the way business is conducted.”

Hillsborough County’s Public Works and TMD established and implemented a clear vision that focused on effectiveness and efficiency. As a result of the desire to continually improve operations, increase service, and reduce costs, Hillsborough County is becoming a national leader in public works efficiency, cost effectiveness, and customer service.

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If you’re involved in structural engineering design/construction projects, you know that reinforced concrete design and fabrication is still primarily performed using manual techniques, with building information modeling (BIM) being used only sparingly. If you are one of the brave souls who has used BIM applications for reinforced concrete projects, you have probably concluded that concrete BIM productivity is lacking when compared with BIM applications for other structural building materials, including for structural steel and even wood/timber framing.

As software vendors compete to capture market share in the reinforced concrete BIM industry, engineers, designers, detailers, and fabricators should ask themselves, “What are the fundamental requirements of a productive BIM product for reinforced concrete?” In other words, what should the software do really, really well? Following are some of the top requirements for effective and efficient reinforced concrete BIM products.

**3D parametric concrete and rebar models** — The two main reasons why engineers and rebar detailers don’t create 3D rebar models are:
- software commands often are too difficult to use, and
- complex or unique rebar layout typically isn’t supported.

Other users stay away from 3D rebar modeling because of the poor performance of the 3D models. Market-leading BIM software should allow users to efficiently create 3D models of any rebar configuration, and the performance should not limit productivity in any way.

For too long, BIM products have been allowed to display rebar as single lines due to performance issues. Those days are gone as BIM products are now expected to handle tens of thousands of bars — all displayed in full 3D — with acceptable performance and viewing capabilities (file opening, zooming, panning, etc.).

**Drawing creation and sheet composition** — When using a software application, the ease of drawing creation and sheet layout is paramount. The software should perform drawing production in ways that are familiar to users: sections, plans, elevations, and details. Any changes made to the 3D model should be reflected automatically in the drawings without user intervention. Moreover, modern drawing methods should be supported, such as by superimposing the 2D sections onto the 3D model.
Customized bar bending schedules and quantity reports
— Reporting on concrete quantities and rebar material lists should be complete and 100 percent accurate. Rebar should be given common bar marks using typical marking schemes chosen by the user. Identical bars should be automatically grouped to reduce the number of unique bars and to minimize fabrication and construction costs. The user also should be able to easily customize the format of all bar bending schedules, quantity reports, and material lists.

Drawing labeling, dimensioning, notes, and cleanup —
It would be hard to calculate the number of reinforced concrete drawings produced during the last 50 years using simple lines and dots/circles for rebar. A BIM application should support all typical ways of displaying the rebar in a 2D format, as well as all typical labeling styles. All data should be derived from the 3D model and consistently maintained and updated.

Exporting to 3D PDF, construction modeling, and IFCs —
The time has come for reinforced concrete BIM to participate fully in the entire project life cycle. Reinforcing models should be usable on mobile apps for construction, clash detection between rebar and embedment should be accurate, and client reviews should be possible without installing heavy desktop applications. Indeed, any 3D models created with the leading BIM product should be usable by downstream solutions for automated bar shearing, automated bar bending, bar tagging, bundling, and shipping.

In terms of the sheer number of unique pieces to be installed, there is probably more rebar on a jobsite than any other building component (aside from fastening systems such as screws or nails). The arrival of stable, dependable BIM software for reinforced concrete projects is long overdue. The good news is, engineers, designers, detailers, and fabricators have more and more choices as software applications continue to mature.

JAMES BARR is director of product management, ProConcrete, with Bentley Systems, Incorporated.
The Harbor Control Tower, a historic water tank and signal tower located near the Pearl Harbor Naval Shipyard, was constructed in 1925. Built jointly by the U.S. Army and Navy, the tower served as an observation deck for monitoring and directing naval traffic in the waterways of Pearl Harbor. Miraculously, the Harbor Control Tower survived the attacks from Japan and remains a prominent structure on the island more than 70 years later. However, despite the tower’s ability to withstand war, its steel components have been no match for Pearl Harbor’s harsh environmental conditions, which are conducive to corrosion. Enter rehabilitation.

High humidity, atmospheric salt, and powerful UV rays combine to form a recipe for corrosion. After years of being exposed to all three conditions, the time had come to restore the carbon steel Harbor Control Tower. In order to keep the tower functioning for port operations, it needed to be repaired. To mitigate corrosion damage in the future and to restore the tower to its original orange and white color scheme, a new coating system was included in the restoration project.

Coatings contractor, Abhe & Svoboda, Inc. had to conduct full lead abatement to remove hazardous material from the tower prior to painting. Enter change orders. “Once we completed sandblasting, we discovered more and more unplanned repairs,” said Nick Schmid, Abhe & Svoboda area manager. “There were holes in the water tank, and the legs needed to be repaired, not to mention rust was encompassing most of the structure.”

Not only were repairs and refinishing necessary, but some components needed complete removal and replacement. The steel components throughout the structure suffered from severe corrosion damage. The stairs, landings, ladders, beams, and flanges — nearly all components of the tower — were affected.

To ensure such damage would not happen in the future, a coating system capable of combating corrosion and providing superior durability and UV protection from the sun’s harsh presence in Pearl Harbor was specified. Sherwin-Williams Protective and Marine Coatings was chosen for the job.

“A base coat that could provide a strong layer of protection and a top coat that could stand up to severe UV exposure were paramount when selecting coatings for the tower,” Schmid said. “An inferior topcoat that couldn’t tolerate extended UV exposure would fade, and when the government spends time and money on a project like this, they want a product that will last.”

Zinc Clad III HS, a polyamide epoxy, zinc-rich coating, was used for corrosion prevention as the base coat. To ensure protection of edges, corners, and welds, Macropoxy 646, a high-solids, fast-cure epoxy, was applied as the intermediate coat. The top coat, Fluorokem HS, played the most crucial role in aesthetically repairing the tower.

“In order to preserve the tower as a historic landmark and to restore its integrity, the original orange and white checkerboard color scheme needed to be achieved,” said Casey Turville, west area district sales manager for Sherwin-Williams. “Color and gloss retention were fundamental performance characteristics when choosing the proper coating system.”

Temperatures in the mid-90s pushed the maximum temperature suitable for coatings application. The tower was fully encapsulated in tarp with scaffolding surrounding the perimeter. Coating application by means of industrial pumps started at the top of the tower and worked its way down.

The coating process started in late summer (when the air was dryer) and took roughly three months to complete. If it were any hotter, coatings application would not be executable. However, temperature was not the project’s only challenging circumstance.

“The biggest challenge during the application process was aligning the orange and white checkerboard pattern in every direction,” Schmid said. “For the final coat, we spent a lot of time measuring out each square with a laser.”

Although the project was slated for completion prior to 2014, the unforeseen structural issues extended the time it took to repair and rehabilitate the Harbor Control Tower at Joint Base Pearl Harbor-Hickam. Restoration was completed in April 2014 and cost $11.2 million.

The Harbor Control Tower is the only remaining water tower of three jointly built by the U.S. Army and Navy in the 1920s. The tower stands tall on the Pearl Harbor skyline in its original color scheme and will serve as a historical reminder for generations to come.

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The Prebys Cardiovascular Institute is the cornerstone of a 25-year master plan unveiled in November 2010 that is transforming the Scripps Memorial Hospital La Jolla campus in La Jolla, Calif. The new Prebys Cardiovascular Institute will be a destination hospital for cardiac care on the West Coast, providing cardiovascular patients with the most advanced treatment options available, while also serving as a center for medical research, clinical trials, and graduate medical education.

Scripps Health retained McCarthy Building Companies, Inc. as the design-assist general contractor to perform preconstruction services for the 383,000-square-foot, $456 million Prebys Cardiovascular Institute and adjacent 26,000-square-foot central energy plant before breaking ground in May 2011. HOK Architects was the project architect. Jacobs Engineering Group Inc. served as the construction management firm on behalf of Scripps. The health system expected to begin treating patients at the new facility in mid-March 2015.

“This is an exciting achievement for us,” said Bruce Rainey, corporate vice president, Construction and Facilities, Scripps Health. “The new Prebys Cardiovascular Institute reflects the most advanced health care design principles together with remarkably high standards of construction. It stands as a model not only for future Scripps facilities, but also for specialized heart care facilities across the country.”

The seven-story, steel-framed tower encompasses 10 levels, including a basement, intermediate mechanical level, and rooftop mechanical level. The exterior of the signature, curved tower utilizes brick, window curtain wall, and cream-colored metal panel systems.

The building will accommodate 59 beds on two ICU levels, 108 beds on three medical surgical levels, six state-of-the-art cardiovascular and two hybrid operating rooms, and three cardiac catheterization labs. A corridor connects the basement and ground levels to the existing hospital.
The first floor encompasses the lobby and shell space for the future build-out of a new emergency department, on which McCarthy is currently performing design-build services with HOK. The second floor houses operating and pre-op rooms, the third and fourth floors accommodate ICU patient rooms and isolation rooms, and floors five through seven house surgery patient rooms. The lower floor houses sterilization rooms.

Located 1,600 feet away, the new central energy plant is a cast-in-place concrete structure encompassing three levels, with two of the levels located below grade. It will provide air conditioning, heating, medical gas, steam, fuel storage, freshwater holding, and emergency generators for the new cardiovascular facility and eventually the entire hospital campus.

“The building design incorporates numerous sustainable design principles and was developed with considerable input from physicians, nurses, and clinical staff to ensure efficiencies that will foster exceptional care in a safe, comforting environment,” said McCarthy Project Director Steve Van Dyke. “Close, consistent communication between project team members throughout the course of construction was key to the ultimate success of this project, with the architect, project inspector, and McCarthy’s project team all based onsite the entire construction duration.”

Six cardiovascular surgery and hybrid operating rooms with charting areas and intervention labs were built to accommodate the most advanced equipment in the industry, provided by three different manufacturers. This required varied and exact mechanical and plumbing systems in each surgery room.

Lean construction principles played into the prefabricated head walls and hand washing sinks in the patient rooms, intensive care units, and prep/recovery rooms. The nurse stations were also prefabricated and use modular casework topped with prefabricated Corian countertops.

Private patient rooms have floor-to-ceiling windows that let in sunlight. The rooms have comfortable, pullout couches for overnight stays by loved ones, as well as flat-screen televisions and wireless Internet access. Warm, soothing earth tones that synchronize with the colors of the sand, surf, and sun of La Jolla were used throughout the facility. Large VIP patient suites at the far opposite ends of the fifth, sixth, and seventh floors provide ample space for patients’ family members to stay overnight, and are isolated for a high degree of quiet and privacy.

Computerized room-level observation stations, a decentralized medication dispensing process, and decentralized nurse stations will allow caregivers to closely monitor patients and facilitate communication with family members. A long bank of windows floods the south-facing side of the second floor and affords 180-degree views. Floor-to-ceiling windows are featured in the teamwork rooms and staff lounges on the fifth, sixth, and seventh floors.

KPFF, Inc. was the structural and civil engineer; exp was the mechanical, electrical, and plumbing engineer; and MWPA was the landscape architect. Subcontractors included Tower Glass for glass, glazing, and sheet metal fabrication and installation; Bergelectric for electrical; A.O. Reed & Company, mechanical and plumbing; Williams & Sons Masonry, Inc., masonry; Schuff Steel Company, structural steel; Arrowwoods Works, Inc., finish carpentry and casework; and Howard’s Rug Company for floor coverings. Valley Crest Landscape Development, Inc. performed landscape, irrigation, site concrete, and outdoor furniture installation. McCarthy self-performed all the structural concrete work.

The institute’s namesake is real estate developer Conrad Prebys, a longtime philanthropist who contributed $45 million to Scripps in 2011 for this project.

Information provided by McCarthy Building Companies, Inc. (www.mccarthy.com).
THE AMERICAN COUNCIL of Engineering Companies-Minnesota awarded architecture and engineering firm LEO A DALY an Engineering Excellence Award for its work on The Connection, an underground pedestrian link at Minnesota State University, Mankato. The 140-foot-long, 12-foot-wide Connection links Minnesota State Mankato’s Memorial Library and the recently renovated Centennial Student Union (CSU), providing sheltered passage to students and faculty during the harsh weather common to the area. This is especially helpful to meet the needs of those with physical challenges.

Additionally, the design includes an outdoor amphitheater cut into the existing grade that allows students to take full advantage of periods of nicer weather. The gentle, grassy slope allows natural light into The Connection through a 33-foot expanse of curtain wall, and provides an outdoor gathering space for socializing, events, and performances at the heart of campus. The Connection’s external wall is clad in weathering steel, forming a counterpoint to a weathering steel sculpture at the east end of the site.

“The Connection represents a very efficient structural solution and a unique tunnel experience. By marrying the economical with the aesthetic, the university gained a valuable student amenity, an expanded teaching environment, and a new campus landmark” said Bill Baxley, design director for LEO A DALY.

The design team of LEO A DALY, American Engineering Testing Inc., and EDR Ltd. overcame a number of engineering and construction challenges to complete the project on time and within a tight, publically funded budget. To accommodate The Connection’s unique “folded” curtain-wall design, engineers designed a mat structure and steel framing that was installed along the entire length and width of the tunnel. The framing supports a sophisticated cast-in-place concrete form, which was necessary to install the design’s corrugated steel wall panels without buckling. The roof decking portion of the framing was joined to the roof without visible connections, requiring custom material fabrication and design.

“This collaborative team immediately recognized that several site factors were going to make the project more challenging than originally expected. They worked together to design a structural system that would accommodate these site conditions and construction challenges as well as address the structural and environmental needs of the space,” said Paul Corcoran, director of planning and construction at Minnesota State Mankato.

Information provided by LEO A DALY (www.leoadaly.com).
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TAPPING INTO MINE WATER GEOTHERMAL

MICHIGAN TECH RESEARCHERS DEVELOP A GUIDEBOOK FOR EVALUATING ENERGY POTENTIAL.

By Allison Mills

MILLIONS OF MILES of tunnels crisscross the ground under old mining communities across the United States. Abandoned, falling apart, and choked with water, the tunnels are often viewed as a dangerous legacy. But the water in these mines could be a major geothermal resource.

Student researchers at Michigan Technological University have put together the first comprehensive guidebook communities can use to explore the feasibility of using mine water for geothermal energy to heat and cool buildings. While there is great potential for this resource, there are fewer than 30 active mine water geothermal systems in the world. One is at Michigan Tech’s Keweenaw Research Center just north of Houghton, Mich.

The research team worked with the Keweenaw Research Center and community leaders in Calumet, Mich., to understand the local potential. In fact, the idea for this project came from community members in Calumet.

In April, the team presented its work to the public in Calumet and in Washington, D.C., at the National Sustainable Design Expo, a student design competition supported by the Environmental Protection Agency (EPA). The project is funded by a People, Prosperity and Planet (P3) grant through the EPA.

The team won the AIChE Youth Council on Sustainable Science and Technology P3 Award. This award was given to one of 40 teams by the American Institute of Chemical Engineers’ Institute for Sustainability and SustainUS, a nonprofit organization of young people advancing sustainable development and youth empowerment in the United States. The award recognizes the team that has the most interdisciplinary and community-engaged project that will have a significant impact on reducing resource use locally, regionally, nationally, or globally and that can benefit youth. The team also earned an Honorable Mention P3 Award from the EPA.

Michigan Tech graduate student Edward Louie spearheaded the project as part of his master’s work in energy policy. “With mine water, you can draw lots of heat from it without it cooling down,” Louie said. The mine water in the Keweenaw stays around 53 to 55 degrees Fahrenheit. These year-round temperatures can then be used to heat or cool buildings using simple technology: mostly pipes, heat exchangers, and heat pumps.

“A heat pump is simply a device that can move and concentrate heat with relatively little energy input,” Louie said, adding the equipment has been around since the 1970s. “The efficiency of heat pumps has gotten better, their reliability has gotten better, but the technology itself is not from Star Trek.”

Louie compared a geothermal heat pump to a refrigerator, which acts as a heat pump. The refrigerator compressor uses a little electricity to move a lot of heat, he said. In a geothermal heating system, the heat pump concentrates a relatively small amount of heat from the mine water, which remains much warmer than the winter outside air, into comfortable temperatures for heating a building. For cooling, the heat pump works in reverse, dumping cooler air into the building. And for every unit of energy used to power the heat pump to do this exchange, the pump can move four — sometimes more — units of heat.
Geothermal systems are inherently flexible, depending on location and the quality of the mine water. In the Keweenaw, where pure copper was dug up, the mine water is relatively clean. In other areas, mine water laden with heavy metals and acid corrodes equipment. For this reason, Louie and his team outlined several open- and closed-loop systems in the mine water geothermal guidebook.

Closed-loop systems help protect equipment from corrosive mine water by exchanging heat outside a loop of corrosion resistant pipes placed inside the mineshaft. The mine water itself is never pumped. In open-loop systems, the mine water is pumped and makes contact with a metal heat exchanger. The advantage is increased efficiency and less piping, but the mine water has to be clean enough.

At the Keweenaw Research Center, mine water is pumped from 300 feet below the surface. Through a big heat exchanger, the mine water cools or heats a closed-loop system within the building.

“It’s just like the radiator in your car,” said Jay Meldrum, the director of the Keweenaw Research Center. “The water always stays inside the pipes and is mixed with glycol so it doesn’t freeze.”

The water-glycol mix circulates and runs through 18 heat pumps throughout the center’s main building. Meldrum said he hopes to expand geothermal on the site and is planning a new, smaller system in a separate building.

“We hope to use geothermal as an educational resource,” he said. “It’s also an area we want to continue doing research in.”

With so few active systems, the Keweenaw Research Center is a unique resource for people living in the region. Tapping into the mine water is also a tribute to the area’s history, said Richelle Winkler, a sociology and demography researcher at Michigan Tech who works with Louie and Meldrum.

“Using the mine water for geothermal energy creates an opportunity to recast community identity,” Winkler said, “which both celebrates the mining heritage and promotes progress forward in an environmentally sustainable way.”

With so much room for expansion, the Keweenaw could become a hub for mine water geothermal. And through the guidebook, Louie, Winkler, and their collaborators could help shape a widespread environmental problem into a solution and resource.

ALLISON MILLS is a science and technology writer at Michigan Tech (www.mtu.edu).
HYDROPOWER PROJECT PIPELINE STILL FLOWS
A NEW ENERGY DEPARTMENT REPORT HIGHLIGHTS U.S. MARKET SIZE, SCOPE, AND POTENTIAL

FOR MORE THAN 100 years, hydropower has delivered a source of clean, renewable electricity in almost every state. Despite recent dam removals for safety and environmental reasons, hydropower still plays a key role in providing flexibility to the nation’s power grids, making it a vital asset to many states’ energy portfolios, according to a new Energy Department report. The 2014 Hydropower Market Report is the first-ever report to quantify the current size, scope, and variability of the nation’s hydropower supplies, the department said.

According to the report, the U.S. hydropower “fleet” has a total capacity of 79.64 gigawatts (GW) — approximately 7 percent of the U.S. electricity supply (excluding pumped storage). The fleet experienced a net capacity increase of 1.48 GW from 2005 to 2013. Hydropower growth was positive in every region of the country but was greatest in the Northwest, where more than 580 megawatts (MW) were added. Most newly constructed projects have been associated with existing water infrastructure, as the hydropower industry has continued developing non-powered dams and conduits.

In an analysis of the current project development pipeline in the hydropower sector, the report estimates that America has more than 77 GW of untapped hydropower resource potential. Most new hydropower projects built during the last decade have added electric generating equipment to dams that were previously not powered. Development of non-powered dams and conduits, along with dozens of new large-scale pumped storage hydropower projects, dominate the current development pipeline, the Energy Department reported (see Figure 1). More than 50 pumped-storage hydropower projects are in various stages of planning and development.

As of December 2014, there were 331 projects in the development pipeline, amounting to a total capacity of 4.37 GW. There are 407 MW of capacity currently under construction, with another 263 MW having received the necessary authorizations. According to the Energy Department, most projects in the development pipeline are in relatively early stages of the development process, having only begun to study project feasibility and apply for necessary authorizations.


Information provided by the U.S. Energy Department (www.energy.gov).
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THE SUSTAINABLE SITES INITIATIVE (SITES) program has certified sustainable landscapes at a dozen new locations across the country for meeting rigorous standards for environmental design and performance. These 12 projects are the last to be certified using a pilot version of the SITES v2 Rating System. They join 34 others that have achieved certification for voluntarily applying the SITES system to incorporate sustainability into their planning, design, construction, and maintenance. SITES projects have now been certified in 20 states.

“Americans can directly address major environmental challenges we face today — diminishing water supplies, climate change, pollution, and loss of wildlife habitat — by how they design and manage landscapes where they live, work, and play,” said Susan Rieff, executive director of The University of Texas at Austin’s Lady Bird Johnson Wildflower Center, which helps lead the SITES program. “The SITES program approach, now increasingly adopted by landscape architects, designers, and others, provides a practical blueprint for creating healthy landscapes, and recognizes exemplary projects to inspire others.”

SITES is a collaboration of the Wildflower Center, the United States Botanic Garden, and the American Society of Landscape Architects.

“These diverse projects prove that you can develop beneficial landscapes of all types and sizes that clean the air, improve water quality, nurture our connection to nature, and more,” said SITES Program Director Danielle Pieranunzi, who is based at the Wildflower Center.

The new projects certified using the SITES 2009 Rating System bring the total certified to 46. The pilot program informed the June 2014 release of the SITES v2 Rating System and Reference Guide. Negotiations are underway with the Green Building Certification Institute to provide project certification to the requirements of the SITES v2 Rating System and a related professional credentialing program.

The following 12 newly certified projects helped field-test the 2009 version of the sustainable landscape rating system, receiving a rating from one to four stars.

**Anacostia Watershed Society Headquarters (★★★★), Anacostia Watershed Society, Bladensburg, Md.** — This landscape, on 0.35 acres, surrounds the historic George Washington House (circa 1752). The building now serves as headquarters for the Anacostia Watershed Society, which developed a public demonstration of a practical, aesthetic way to address the flow, collection, and management of stormwater runoff from the site. Years of adjacent road realignments that raised the grades of surrounding lands had created poor drainage patterns throughout the site. With the help of volunteers, interns, staff, and local business donations, the society was able to install permeable paving, a rainwater cistern, brick and dry-stream channels, and rain gardens. The project demonstrates how sustainable stormwater management can be successfully incorporated within historic sites challenged with a limited budget and very restrictive site constraints.

**Evans Parkway Neighborhood Park (★★★★), OCULUS — Landscape Architecture, Silver Spring, Md.** — The expansion of this neighborhood park with the addition of a vacant lot provided the impetus for developing a more natural treatment of park surfaces and restoring a 300-foot section of a concrete-lined stream channel. This rehabilitated stream is a model for future naturalization efforts within Montgomery County. The renovated park also includes an informal...
Boeddeker Park (★★). The Trust for Public Land, San Francisco — This one-acre park developed by The Trust for Public Land and San Francisco Recreation and Parks provides the largest open space in San Francisco’s poorest, most dense and diverse neighborhood. What had been an undesirable, unsafe area for 50,000 nearby residents has become an inviting space that is open daily. The pocket park includes a state-of-the-art clubhouse, walking path, adult fitness equipment, children’s play area, lawn and plazas for community gatherings, and a garden. Sustainable systems were prioritized from the start and are integrated throughout the site. Project partners conducted extensive community outreach at nearby senior and youth centers and elsewhere, and worked closely with local community partners to ensure a safe park that provides programs and activities for all ages. Key design and programming decisions were made through these community forums. The result is a model of civic engagement, inspiration, resource conservation, and adaptability.

Hempstead Plains Interpretive Center (★★). RGR Landscape Architecture & Architecture PLLC, Garden City, N.Y. — This is the only naturally occurring prairie east of the Allegheny Mountains. The design and development of HPIC — a low-impact building and site — in a heavily developed suburban area, secures the integrity of the parcel as a natural preserve and historic landmark. In addition, the Plains are located on the Nassau Community College campus and near several universities, providing classes with a learning lab about native prairie habitats and sustainable techniques and an experience for general visitors interested in experiencing prairie life. An entrance through native plantings leads to the new visitor’s center topped with a green roof; open and closed classrooms are provided. Handicapped-accessible and stabilized-soil trails lead to the natural paths in the native prairie. A cistern helps reduce the need for potable water. Solar energy provides power and the building is completely “off the grid.”

Luci and Ian Family Garden at the Lady Bird Johnson Wildflower Center (★★). W.G. Smith Design, Austin, Texas — This garden showcases Texas native plants and landscapes while offering a unique, beautiful space for children and families to appreciate nature through exploration and to learn about plants, wildlife and water, and sustainable landscape design elements. The 4.5-acre space features more than 180 native Texas plant species and interactive features such as a nectar garden, a wildlife blind and pond, a “stumpery” made for tree climbing, and an area for building structures from natural materials. Sustainable practices are part of the fabric of the garden, and include plants that were salvaged preconstruction and replanted, and a rainwater harvesting system and rain gardens to demonstrate water conservation. Locally sourced pecan shells and crushed recycled glass are among the mulches. Stone harvested onsite is used in features such as two caves, and non-potable water feeds a waterfall flowing into a recirculating creek with fish and tadpoles.

U.S. Federal Office Building (★★). GSA with Atkins Global, Miramar, Fla. — This new building houses a key federal agency on a secure campus that includes a parking garage with a green wall and solar panels, pond and other sustainable features on a site that minimizes impacts and harmonizes the landscape with the nearby Florida Everglades. The site design incorporates wetlands throughout the project and in interior and exterior courtyards. Structures are made of locally sourced materials with high recycled content and FSC-certified wood. Native and adaptive plant
species occur site wide, creating a sustainable native plant community on aesthetically appealing grounds. The grounds also provide water-quality treatment for the project area.

**Environmental Laboratory for Sustainability and Ecological Education (★)**, Alrie Middlebrook, San Jose, Calif. — This former concrete parking lot in downtown San Jose has become a shared garden space used for educational purposes. The tenants include a sustainable landscaping company, The California Native Garden Foundation and its nursery, and an onsite aquaponics farm. The Environmental Laboratory (ELSEE) is used to teach schools how to build a sustainable garden education program and showcases a healthy land-use model. The site demonstrates urban food technologies such as vertical food towers, pallet gardens, composting, and gardening with perennial food plants. Drought-tolerant native plants reduce water use and provide wildlife habitat, restore soils, and more. Drip irrigation is used for plantings, and water is reused through greywater systems. Many landscape components are made with recycled or reused material. The goal of ELSEE is to have this type of garden model adopted by 10,000 California schools by 2020.

**HELIX Environmental Planning Inc. Headquarters (★)**, HELIX Environmental Planning Inc., La Mesa, Calif. — Landscape conversion of the environmental planning firm’s headquarters entailed conversion of the landscape to a more regionally appropriate one. The project reduced potable water use for irrigation through rainwater harvesting and the use of native plants, and created a more usable outdoor space for employees, which has increased social interaction and supported healthy activities. The project is unique because it used the expertise of HELIX’s own employees in designing and implementing water-conserving and lower-maintenance landscapes.

**New Orleans Festival and Recreation Complex (★)**, Torre Design Consortium, New Orleans — A 55-acre abandoned golf course in New Orleans City Park was repurposed to provide a public space, in conjunction with a Community Development Block Grant. Community input led to opportunities for exercise and outdoor play, and gathering spaces for families, schools, and formal events. The project includes four multi-sport fields, a one-mile walking/biking path, a workout area with adult and child exercise equipment, a large constructed wetland area with meditation paths and a boardwalk, a playground, and a large “Reunion Pavilion” for seating, eating, and socializing. Many oak and cypress trees were retained for shade and enjoyment.

**Perot Museum of Nature and Science (★)**, Talley Associates, Dallas — This 4.7-acre site on a former industrial brownfield is just north of downtown Dallas and west of the Arts District. An elevated freeway determines the sites southern boundary and is among nearby constraints. The project dovetails with the museum’s primary mission of working to “inspire minds through nature and science.” To achieve this, the site design was conceived as an abstraction of several native Texas landscape environments that are seamlessly integrated with the building’s architecture that covers much of the space. Starting at the southeast corner of the site, the podium structure of the building was planned to incorporate a vegetated roof system. The roof features plantings that depict different regions of Texas’ ecology: West Texas Caliche, Upland Prairie, Blackland Prairie, and East Texas Forests/Wetlands.

**Swaner EcoCenter (★)**, CRSA, Park City, Utah — The EcoCenter provides visitors a starting point to experience the 1,200-acre Swaner Preserve, both of which are overseen by Utah State University. The
preserve and building serve as places for teaching environmental science. Visitors also hike, bird watch, and pursue other nature activities onsite. The EcoCenter building demonstrates sustainable features such as solar panels and a cistern for rainwater collection that eliminates potable water use for irrigation and for flushing toilets. The acres of wetlands are protected by conservation easements. They undergo continuing restoration to improve water quality and wildlife habitat for elk, red fox, and other animals such as 90 bird species. Visitors can enjoy an innovative boardwalk that minimized disturbance to land around the piers. Rather than using metal helical piers that produce such damage, the boardwalk piers are of salvaged trestle wood preserved by sitting in the Great Salt Lake for decades. Other approaches included selecting sustainable materials for outdoor seating, bike racks, and pathway pavers.

Tuthill Corporate Headquarters Campus (★), Conservation Design Forum, Burr Ridge, Ill. — The campus provides a workplace environment that honors the human psyche and improves the environment. The building was established on a minimal footprint and oriented to allow employees to easily access a pond/wetland and view it while indoors. Rainwater is collected and directed from the roof to the landscape. The entire site, except for the building footprint, pavement, and small Buffalo grass turf edge, has been restored to hardy, native plant species obtained locally wherever possible. Locally sourced limestone was used in a terrace and patio that creates an authentic connection of the building to the local landscape. Invasive species have been removed, allowing the restoration of native grassland prairie and wetland fringe. The restored or recreated onsite landscaping and other elements virtually eliminate stormwater runoff and localized flooding.

For more information about the SITES program, visit www.sustainablesites.org.

Information provided by the Lady Bird Johnson Wildflower Center at The University of Texas at Austin (www.wildflower.org).
The layout of the property offers an inviting space for residents and allows for greater foot and vehicle traffic, with updated street patterns. Photo: Courtesy of Andy Ryan

REDEFINING PUBLIC HOUSING
DISTRESSED SOUTH BOSTON PROPERTY IS RENOVATED AND REBUILT TO SUSTAINABLE STANDARDS.

DURING THE LAST 10 to 15 years, South Boston has experienced more redevelopment than any other part of Boston. Once known for its shipyards and warehouses, South Boston has become a trendy place for young professionals to live and a home for the city’s burgeoning start-up community. But it still retains many of its public housing communities, including Old Colony, one of the nation’s oldest public housing communities.

Originally built in 1940, Old Colony had become the most physically distressed property in the Boston Housing Authority’s portfolio and was considered one of the worst examples of public housing in the country. To put it simply, it was in desperate need of redevelopment. After receiving federal funding, the Boston Housing Authority selected Beacon Communities Development to undertake the project, and they in turn selected The Architectural Team as a design partner and Suffolk Construction for Phases One and Two A + B.

The goal was to renovate and rebuild Old Colony into “The Homes at Old Colony” — a new type of public housing that would feature sustainable design elements; a learning center; and apartments for individuals, families, and people with disabilities.

The project began in 2010 and took four years to complete. And now, in its first year of occupancy, The Homes at Old Colony have become a national model for sustainable, public housing projects.

Focus on green building

When designing the master plan for the Old Colony redevelopment, The Architectural Team and Suffolk Construction placed a special emphasis on green building and energy efficiency.

Prior to the renovation, the Old Colony facilities were crippled by aged systems and rundown infrastructure. So much so, that each unit’s energy and water costs soared above average; the annual rate per unit was more than $4,000, an astronomical fee for residents of a public housing facility.

By introducing sustainable design principles and low-impact development strategies into the construction process early on, the team was able to design and construct the new facilities to achieve LEED Gold certification for the learning center, LEED Platinum certification for the residential buildings, and LEED for New Development as their overall goal.

In demolishing the existing facilities, Suffolk Construction saved, reused, and repurposed elements of the old buildings into the new. Recycled content was used in construction materials such as drywall, flooring, steel and metals, cement, and aluminum.
In addition, the Suffolk team was able to use its value engineering process on the foundation system. Through this process, they preserved and retrofitted the existing foundations to meet the new building requirements. On average, these efforts saved the project more than $1 million without sacrificing any of the original green building design features.

Energy conservation was another critical part of the construction and design considerations. As the new buildings were erected, Suffolk worked with its subcontractors to optimize the levels of insulation and air sealing throughout the buildings. The higher-rise buildings used exterior spray-foam insulation for thermal protection as well as air sealing, while the townhomes used a medium-density spray to fill the wall cavities and rigid insulation blankets on the exterior to minimize flow of hot and cold air through the buildings.

These insulation efforts were coupled with building components — central heating, air conditioning, hot water, etc. — that are high efficiency and Energy Star-certified. Additionally, each living unit is equipped with a heat-recovery ventilator (HRV) or energy-recovery ventilator (ERV) that continuously exhausts a steady, but small stream of air from bathrooms.

The owners also wanted to take advantage of the property’s location along Boston’s coastline by maximizing solar exposure. New construction was oriented in such a way that the building’s 140 kW photovoltaic panels would be collecting power and generating energy throughout the day. The panels were installed on all of the buildings constructed during Phases One and Two A + B, and the electricity and power generated from the panels is used to power the common areas.

**Neighborhood-friendly design**

Beyond the building design itself, The Architectural Team and Suffolk worked closely with the project team to transform the neighborhood around The Homes at Old Colony. The look of the buildings better fits with the surrounding South Boston neighborhood and creates a more welcoming atmosphere to residents and neighbors. Additionally, the new roads helped to knit the community back together.

The layout of the property also offers an inviting space for residents and visitors alike. It allows for greater foot and vehicle traffic, with updated street patterns, and provides greater access to the nearby park and beach.

Alongside the living facilities, a newly constructed 10,000-square-foot learning center provides social service and educational programs for community members.

**Impact**

The Homes at Old Colony have become a national model for multifamily housing and sustainable urban living. In fact, the project was awarded multiple times. In 2012, Phase One was recognized as the “Best Urban Project” Readers’ Choice Award from Affordable Housing Finance magazine, and Phase Two was honored in 2013 with the Boston Society of Architects Design Award. It is also designed to EPA’s Energy Star and HUD Healthy Homes Guidelines.

Information provided by Suffolk Construction (www.suffolk.com).
ARKANSAS-BASED Morrison-Shipley Engineers, Inc. (MSE), which provides civil engineering, land surveying, and laser scanning services to a wide variety of public- and private-sector clients, recently worked on a large transportation project for the Fort Smith Regional Airport in Arkansas. The three-phased, $9 million project involves widening the airport’s primary taxiway 60 feet over a length of about 4,000 feet. Construction includes building a pavement section of 14 inches of portland cement concrete over 4 inches of hot mix asphalt, both placed on a compacted subgrade with all construction meeting strict Federal Aviation Administration specifications.

Morrison-Shipley is the project’s engineer of record and is providing surveying, engineering design, construction inspection, and administration services for the airport. Construction of the first and second phases was completed in 2012 and 2014, respectively. The third phase of the project began in September 2014 and is scheduled for completion in July 2015.

During the project, the design team had to adhere to evolving design standards and regulatory requirements — as well as accommodating a late-stage adjustment to the second phase, which meant moving some aspects of the design from the third phase to the second. In addition, the project site itself posed a challenge.

“This is an active airport, with commercial service as well as operations for private and military aircraft,” said Brian Maurer, Morrison-Shipley’s project manager for this project.

To help ensure the safety of flight operations, the FAA sets tight limits for construction zones, resulting in a high density of people and construction equipment working in close proximity. “This congestion makes it difficult to use traditional surveying methods,” Maurer said. “But regardless, we need to perform surveys of work in progress.”

Morrison-Shipley has been using intelligent modeling software for design and documentation throughout the project. The dynamic modeling capability of the software enables creation of automatically adjusting 3D surfaces, alignments, profiles, and corridors for terrain, utilities, and grading.

“Using conventional CAD technology, changing our design and documentation to accommodate the project phase adjustment would have seriously jeopardized our deadlines and budgets,” said Jeff Nichols, CAD manager at Morrison-Shipley. “But the dynamic nature of AutoCAD Civil 3D enabled us to efficiently make all the necessary adjustments in the model — confident that the changes were automatically reflected in the project drawings.”

To quickly perform onsite surveys, the firm uses laser scanning technology combined with Autodesk ReCap software to process the resulting point clouds for use in Civil 3D. “With laser scanning, we can quickly and safely carry out high-precision data collection at the job site with just one surveyor, greatly reducing risk of rework or delays at the job site,” Nichols said.

Model-based design
“Today, the majority of our work is accomplished using Civil 3D,” said Diogo Carreira, a CAD designer at Morrison-Shipley. “We use the software to design surfaces, alignments, profiles, cross-sections, corridors, and grading objects. We also use it to manage survey data, produce documentation, and calculate quantities.”

Additionally, the firm uses the survey and map features of Civil 3D for survey control and to integrate GIS data with its designs. “If we adjust a cross-section — whether it’s to see how it impacts earthworks or to adhere to new design standards — the grading automatically updates,” Carreira said.

This dynamic change capability has been particularly important on the Fort Smith Regional Airport project.

“When the decision was made to incorporate parts of phase three design elements into phase two, we had to adjust both sets of plans,” Carreira said. “But instead of manually updating all the drawings, we just resplit the corridors and profiles, and all the documentation updated automatically.”

“On the Fort Smith Regional Airport project, we estimated that there was a 30 percent (or more) drafting efficiency gain since implementing Infrastructure Design Suite,” Nichols said. “This is primarily due to the dynamic relationship between the design models and the construction plans.”

Capturing reality
Morrison-Shipley supplemented conventional surveying methods with 3D laser scanning to capture existing conditions of the taxiways and the surrounding environment. The firm is periodically reusing the existing conditions data during the design, avoiding the need for its survey department to make costly return trips to the site. Based on the specific design area,
the team clipped out smaller amounts of specific survey data from the point cloud, which reduces the processing burden of its computer hardware.

In addition, Morrison-Shipley is using laser scanning technology to survey in-progress work — documenting subsurface conditions during construction and calculating earthwork quantities. For example, on the Fort Smith Regional Airport project, the firm is laser scanning undercuts of existing subgrade soils and importing these point clouds to determine quantities of excavated material. These measurements are then used by the airport to determine payment of fees to contractors. The firm also uses this reality data to compare as-constructed conditions against its as-designed improvements — verifying the scanned survey data against the finished grades called out on project drawings.

**Vehicle tracking**
Morrison-Shipley is also evaluating aircraft movements on this transportation project as well as other site design projects.

“In the past, we typically outsourced the creation of visual aids and project renderings,” said Tammie Lunsford, CAD manager at Morrison-Shipley. “But since Infrastructure Design Suite Premium contained Autodesk InfraWorks 360 LT software — which can be used to develop project renderings and animations even at the early design stage — we decided to create the visualizations ourselves.”

The firm imported its Civil 3D conceptual design as well as the architect’s building design model into InfraWorks. In addition, the firm pulled GIS data and aerial photography into InfraWorks to provide visual context for the project.

“We were able to easily import all of this data, and use InfraWorks to quickly model some surrounding buildings and landscape to provide greater realism of the physical environment around the building,” Lunsford said. In just a week, the team produced multiple snapshots of the proposed improvements, as well as a fly-through video. “We were able to quickly and efficiently develop the renderings and animation — and then we turned the anticipated expense of outsourcing this work directly into revenue,” Lunsford said. “In addition, our client was absolutely thrilled with the results.”

As a result of the knowledge gained on this project, Morrison-Shipley has since expanded these types of visualization to its other design projects.

“The biggest benefit is the dynamic nature of the modeling environment and that drawings are automatically updated when the model changes,” Nichols said. “This means we’re able to do a lot more in less time. And we’re not limited by our software — it can handle the full scope of our imagination and design creativity.

“Using InfraWorks, we routinely combine pipe networks and roadway alignments from Civil 3D, building models from Autodesk Revit Structure, and point cloud data from ReCap,” Lunsford said. “This saves our company significant funds. But more importantly, the ability to seamlessly bring together multiple file formats and visualize the project (and the surrounding site) as a whole helps inform our design and streamline the process — to the point where we are realizing a 40 percent time savings during design.”

“We can virtually test many variations of our designs, and more effectively communicate those different design options to our clients,” Nichols said. “As a result, we have gained the trust and confidence of our clients and the community, helping to increase our market share and expand our business.”

**Bentonville administration building**
In another project — the administration building for the City of Bentonville, Ark., water department — the firm provided surveying, platting, site design, and landscape design services for a 7,600-square-foot utility administration building and site improvements on a 2.3-acre parcel. Morrison-Shipley used Civil 3D software for the project’s site, water, and sewer design, and also Vehicle Tracking software to analyze the maneuverability of large trucks and heavy equipment through the congested project site.

During the conceptual phase of the project, the client asked Morrison-Shipley to develop a proposal for the same building on an alternative site. In addition, the client needed a formal presentation of the project to support outreach to the city’s governing council and the general public.

“During the conceptual phase of the project, the client asked Morrison-Shipley to develop a proposal for the same building on an alternative site. In addition, the client needed a formal presentation of the project to support outreach to the city’s governing council and the general public.
ENHANCING ROADS AND ENVIRONMENT
MEAD & HUNT WINS ENGINEERING AWARD FOR WIS 29 IMPROVEMENTS.

THE AMERICAN COUNCIL of Engineering Companies of Wisconsin recently recognized national engineering and architecture firm Mead & Hunt for excellence in engineering for its role in the roadway and interchange design for Wisconsin State Route 29 (WIS 29) in Marathon County. The roadway and interchange received essential safety upgrades, and using innovative engineering techniques, Mead & Hunt enhanced the natural environment and provided better opportunities for native plants and animals to thrive.

The initial goal of the project was to provide safety improvements along WIS 29, one of the most important and highly traveled east-west roadways of the state highway system. Using an integrated approach to design, Mead & Hunt’s collaborative team of scientists and engineers improved fish habitat, wetlands, and floodplains with the new interchange.

According to Project Manager John Rathke, “The design team faced a project with sensitive environmental areas, a rolling terrain, and an obsolete roadway geometry due to shallow granite bedrock. The team met the challenge and designed an interchange within existing roadway constraints while minimizing environmental impacts.”

Initial safety upgrades to this stretch of WIS 29 included improvements to vertical profiles to provide adequate sight distance along the roadway, removal of at-grade intersections, and the addition of a new interchange. The project also included increased corridor speed limits for consistency with the rest of WIS 29, installation of a concrete safety barrier in the median to separate opposing traffic, and the addition of a snowmobile trail at the interchange to allow safe crossing of WIS 29 and promoting multi-modal transportation in this area.

Unforeseen challenges arose when the Wisconsin Department of Natural Resources (WDNR) discovered that fish spawning habitat had been lost upstream of WIS 29 due to construction of several structures in the 1990s that blocked fish migration. As a result, fish spawning areas were limited, causing a reduction in natural reproduction.

Mead & Hunt put the environment at the forefront in its design process. The team installed a creek bed within structures underneath WIS 29 that mimicked the depth, flow, and feel of a natural stream. This allowed fish to return to their natural breeding grounds while also increasing the size of their natural habitat.

Mead & Hunt collaborated with the Wisconsin Department of Transportation and the WDNR to devise a system that allowed the native fish to return to their natural migratory breeding area for the first time in decades. Wetlands were also enhanced by creating a site that improved floodplains attenuation and, through careful selection of hearty native plants, prevented invasive species from flourishing.

From start to finish, this project exemplified sustainable practices. By incorporating environmental factors into the design, Mead & Hunt delivered a safer, more accessible roadway for travelers that successfully improved the environment along the corridor, providing local habitats with an opportunity to return to their natural states.

Information provided by Mead & Hunt (www.meadhunt.com).
THE GO-TO SITE FOR COMPANIES THAT ARE LOOKING FOR QUALIFIED CANDIDATES IN THE AEC INDUSTRY.

AECWorkforce.com is a job board dedicated to the Architecture, Engineering and Environmental Consulting industry. We strive to be the go-to site for companies that are looking for qualified candidates in the AEC industry.

Our goal is to keep this job board simple. We want our site to be quick and easy for both the company that is posting and the candidate that is applying.

Feel free to contact us. Phone: 479.856.6260 Email: info@aecworkforce.com or chat live at aecworkforce.com
The Fort Hall Indian Irrigation Project (FHIIP), located in southeast Idaho, is currently dealing with problems common to many irrigation systems across the western United States — the project faces ever growing rehabilitation costs while operating within an extremely limited budget. The project’s aging infrastructure includes several individual facilities, each of which carries a multimillion dollar price tag for rehabilitation/replacement.

One such facility is the Tyhee Siphon. Repair of this facility presents many challenges, making the total project a seemingly insurmountable obstacle. In line with the old adage of how to eat an elephant (one bite at a time), the FHIIP is completing rehabilitation of this facility in phases over several years, and recently completed the first phase of construction.

The Tyhee Siphon was originally constructed in the early 1900s as a 78-inch concrete pipe, and serves as a primary water conveyance structure of the FHIIP. The siphon is located about two miles south of the Fort Hall Indian Reservation in Bannock County, Idaho, within the of City of Chubbuck, and delivers 230 cubic feet per second of irrigation water to roughly 11,500 acres of farmland. At some point after initial construction, about 900 feet of open canal leading to the siphon was replaced with similar cast-in-place concrete pipe, increasing the total length to roughly 5,400 feet. The siphon was rehabilitated in the 1940s by installing a steel lining sleeve inside the concrete host pipe to seal the leakage from the concrete pipe. Appurtenant structures to the siphon include a wasteway/drain, an air vent, and one irrigation delivery.
A growing problem
Over time, the steel liner and the concrete pipe have deteriorated to the point that leaks are now common. Previous inspections have revealed that the steel liner was not firmly anchored to the host pipe, except at the inlet and outlet portals, resulting in a void between the liner and the host concrete structure. The liner is severely corroded, has no remaining structural integrity, and is sagging under its own weight and flaking off into the water flow.

Because of the gap between the steel liner and the concrete, it was not possible to inspect or obtain measurements of the concrete host pipe without creating more leaks in the steel liner. This made it difficult to determine whether the concrete pipe was failing and deforming along with the liner. The siphon is located adjacent to, and partially under, Siphon Road, which is a city street adjacent to businesses, a residential area, and an elementary school.

Leakage expressed itself along the length of the siphon in a variety of ways: Chronic potholes developed in the overlying road surface; sand boils and water coming from the sides of the roadway embankment and saturated soils created marsh areas in an otherwise arid environment. Leakage from the siphon directly impacted traffic safety and led to regular closures of the westbound lane. Further, because pothole formation and sand boils are indicators of water movement along the outside of the pipe, there are concerns that the surrounding utilities may be compromised in the event of a catastrophic collapse of a soil bridge.

Replacement of the siphon is further complicated by crossings under both a Union Pacific railroad line and the Yellowstone Highway, in addition to the many municipal utilities that surround the siphon, including both gravity and force main sanitary sewers, water mains, storm drain systems, natural gas, fiber optics, and overhead power.

The siphon cannot be removed from service during the duration of the irrigation season, which is typically mid-April through mid-October. Consequently, all repair and rehabilitation activities must occur during the late fall and winter. Replacement of such a large diameter structure with so many significant potential impacts is an extremely risky and expensive proposition.

Trenchless construction
Given the many challenges associated with traditional cut-and-cover replacement methods, rehabilitation in place is a desirable alternative. However, while rehabilitation in place is significantly less expensive in this case than complete replacement, the multimillion dollar cost to rehabilitate 5,400 feet of 78-inch-diameter pipe is still an expense that greatly exceeds most irrigation district capital improvement and maintenance fund budgets. To make this project viable, the siphon had to be rehabilitated in phases in which the time span between phases may be many years as the FHIIP sets aside enough money to rehabilitate the next reach.

The Bureau of Indian Affairs selected consulting firm DOWL HKM through the RFP process to evaluate how to best return the siphon to optimal performance, including complete reconstruction of the utility. DOWL HKM is a multi-disciplined firm owned by senior managers of the company. It has 400 employees and 23 offices throughout Alaska and seven other states.

The contract included a study phase to identify and evaluate alternatives, a design phase to develop plans, specifications to construct the selected alternative, and services to represent the owner while the work was underway.

DOWL HKM performed a detailed field investigation that included internal survey and dimension measurements as well as external test pits and concrete coring. The results of these investigations were used to develop a phased rehabilitation plan for construction.
Long-term solution

McMillen of Boise, Idaho, was awarded the project. McMillen is a woman-owned business founded for the purpose of providing environmental and natural resource engineering and construction services. It was awarded the project through the U.S. Small Business Administration 8(a) Business Development Program, which helps small, disadvantaged businesses compete in the marketplace.

The phasing sequence began at the diversion into the siphon and progressed toward the siphon outlet. This most upstream reach was chosen as the first phase of construction, as it was known to be in terrible condition and it was the only place where conventional replacement would not be complicated by adjacent utilities and would have a minimal impact on the traveling public. The ability to fully excavate the siphon allowed for large launch/receiving pits from which to conduct “pilot” slipline operations, which provided the first opportunity to evaluate the host pipe for deformation.

Phase 1 was completed during the fall and winter of 2012-2013, including rehabilitation of roughly 20 percent of the total siphon length in three slipline segments and two direct replacement segments using 72-inch-diameter Hobas centrifugally cast fiberglass reinforced polymer mortar (CCFRPM) pipe. Slipline preparation involved removing the deteriorated liner and measuring the roundness of the host pipe to develop a slipline plan that included installation of EPDM runners as low friction guides and to maintain an annular space around the full circumference of the new carrier pipe.

The existing siphon could not be removed from service during the irrigation season; consequently, all sliplining activities must occur throughout the late fall and winter.

The first 900 feet of the siphon barrel was in extremely poor condition, but despite the severely deteriorated condition of the liner, much of the host pipe was found to be in excellent condition. It required only minor reshaping of the concrete pipe to successfully slipline the new carrier pipe. Once the slipline was complete for each segment, a bulkhead was constructed of dry pack grout around the circumference of the carrier pipe at each end of the slipline. Then cellular concrete was pumped in to fill the annular space between the new carrier pipe and the host pipe.

Cellular concrete is a lightweight (approximately 40 pounds per cubic foot), high-flow, low-strength cementitious grout. It incorporates a foaming agent into a mix of neat cement and water to bulk up the mixture and produce a highly fluid, fresh grout that can be used to fill the annular space of several hundred feet of sliplined host pipe. The highly fluid nature of the grout is an important design characteristic as it allows the grout to flow freely out through cracks and open joints in the host pipe, filling soil voids around the exterior of the pipe.

A gage was installed in the grout feed line to monitor the application pressure; the cellular concrete mix design resulted in a mixture that was so fluid that the grout pressure did not exceed 3 psi. Compressive strength testing on samples cast in the field resulted in 28-day compressive strength results of approximately 300 psi.

The Phase 1 Tyhee Siphon rehabilitation project was extremely successful. Construction duration was approximately four months, and was completed between irrigation seasons. Phase 2 of the rehabilitation was scheduled for the fall and winter of 2014-2015, incorporating similar sliplining techniques to limit impacts on the traveling public and risk to adjacent utilities. Although the project is many years from completion and several construction phases are still required, the FHIIP has made significant progress toward complete rehabilitation of this vital project component.

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ADVANCING SUSTAINABLE INFRASTRUCTURE WITH ENVISION

By Denise Nelson, P.E., ENV SP, LEED AP

THE ENVISION RATING system for sustainable infrastructure is the new international reference for best practices for all types of infrastructure. After three years in the industry, Envision has been used to improve hundreds of projects, and thousands of professionals have earned the Envision Sustainability Professional (ENV SP) credential.

Project teams are reporting their satisfaction with Envision as a comprehensive approach to sustainable infrastructure projects. The transparent framework and scoring metrics provide a logical approach for incorporating the triple bottom line and determining the true value of project features. Envision promotes documentation of design decisions and actions as well as monitoring of the impact of those actions. As noted by Deborah Weintraub, interim city engineer for the City of Los Angeles, “Envision expands our over a decade long use of green rating systems for buildings to civil engineering projects. We believe this is urban design at its best.”

Beyond the hundreds of project self-assessments, six projects have completed third-party verification and received awards, several projects are currently in the verification process, and dozens more are on the path toward an award. The six projects with Envision awards are:

The William Jack Hernandez Sport Fish Hatchery, Anchorage, Alaska, received an Envision Gold award in July 2013. This brownfield redevelopment incorporated sophisticated recirculation technology that reduced the water and energy normally used by conventional hatcheries.
by 95 percent while supporting the sport fishing industry. The project restored and improved a public park-like setting and viewing areas with trails, boardwalk, and educational signs while protecting the onsite stream.

The **Snow Creek Stream Environment Zone Restoration**, Placer County, Calif., earned an Envision Platinum award in November 2013. Another brownfield restoration, this project also restored historic wetlands and the stream environment zone by removing fill and debris and reestablishing vegetation and wildlife habitats. This project also created a public park with walking paths.

The **South Los Angeles Wetland Park** in Los Angeles earned an Envision Platinum award in January 2014. The purpose of the wetland was to enhance the quality of stormwater runoff by treating runoff from a 525-acre contributing watershed to create a new public park in a community with little green space.

The **Sun Valley Watershed Multi-benefit Project** in Los Angeles County, Calif., earned an Envision Platinum award in August 2014. The project consists of several improvements in the watershed to manage stormwater runoff, provide flood protection, improve watershed health, increase open space and recreational opportunities, and increase wildlife habitat.

The **Line J, Section 1 Pipeline** in the Tarrant Regional Water District of north central Texas earned an Envision Silver award in October 2014. This two mile, 108-inch-diameter pipeline delivers water from reservoir for use to meet potable demand. The project improves the ability to meet growing water demands and future projections.

The **Grand Bend Area Wastewater Treatment Facility** in Ontario, Canada, on the shoreline of Lake Huron, earned an Envision Platinum award in February 2015. This project is the first Envision verification in Canada, and the first wastewater facility to earn an Envision award. The project expanded the capacity of the facility by converting an existing lagoon into an extended aeration mechanical treatment facility and wetland nature reserve.

Besides rating projects for a score, Envision can be used in any phase of the project life cycle to guide the decision-making process. It has also been used other ways, such as improving funding prospects, criteria in design contests, and facilitating public outreach. Significant examples include:

- The California Department of Water Resources increases state cost share for projects achieving Envision awards: 5-percent increase for an Envision Gold award and a 10-percent increase for an Envision Platinum award.
- The Inter-American Development Bank's Infrastructure 360° Awards program requires submittal of an Envision checklist for entry into the competition.
- Edina, Minn., used Envision as part of its community outreach related to the 54th Street Reconstruction and Arden Park Area Stormwater Management Plan. Envision was used as the framework to inform stakeholders of the environmental, social, and economic advantages of various project components and design scenarios.
The Envision rating system for sustainable infrastructure is a collection of best practices that provides guidance for decision making throughout the entire project life cycle. It includes 60 credits, or sustainability concepts, organized into five general categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk.

Envision is also a rating and scoring system for determining sustainable achievement and earning project awards. Award levels, based on the points achieved by addressing the 60 credits, include bronze, silver, gold, and platinum.

Envision was created as a joint collaboration between the Institute for Sustainable Infrastructure (ISI) and the Zofnass Program for Sustainable Infrastructure at Harvard University Graduate School of Design. ISI was founded by three national engineering associations — the American Society of Civil Engineers, the American Council of Engineering Companies, and the American Public Works Association — with the charge to develop and administer the Envision rating system for sustainable infrastructure.

ISI provides continued Envision development, issues ENV SP credentials, and manages the Envision project verification and award program. More than 3,000 professionals worldwide have earned the ENV SP credential.

ISI also offers memberships to public, private, and academic organizations and individuals to support the development of a community of practice around sustainable infrastructure. Membership comes with discounts on the professional credential and project award programs.

DENISE NELSON, P.E., ENV SP, LEED AP, is vice president for public education at the Institute for Sustainable Infrastructure (www.sustainableinfrastructure.org). Her responsibilities include education and training for public- and private-sector organizations and overall coordination of messaging and promotions related to Envision. She has more than 12 years of engineering experience related to public utilities and sustainable development in the United States and internationally.
Expanded polystyrene (EPS) geofoam is best known for its use on roadway and embankment projects. An engineered lightweight material with high compressive strengths and predictable material performance, ACH Technologies’ Foam-Control EPS Geofoam has become an indispensable material for civil infrastructure. Among the reasons for its popularity: the material has high compressive resistance, it reduces lateral and bearing loads, and saves labor and project costs. At about 1 percent the weight of traditional earth materials, this cellular plastic material has a compressive resistance as high as 18.6 psi at 1 percent deformation.

These same properties are making Foam-Control EPS Geofoam an ideal building material with innovative engineers, contractors, and architects looking for a strong, lightweight material that provides predictable performance and is easy to install in commercial applications. Across the country, geofoam is being used in everything from structural underslab foundation fill to pool profile fill and embankment structural support for levees or berms.

Reborn wetlands
In Northern California’s San Pablo Bay, about 40 miles inland from San Francisco, construction has been underway to restore the wetlands at Cullinan Ranch. Ducks Unlimited and the U.S. Fish and Wildlife Service (FWS) are working together to restore more than 1,500 acres of tidal wetlands in the San Pablo Bay National Wildlife Refuge. The site had been diked off from the tides for more than 100 years and was farmed primarily for oat/hay production. Before the tidal waters could be reintroduced, a three-mile stretch of levees along Highway 37 needed to be protected from erosion.

In order to mimic natural transitional zones from wetlands to uplands, the FWS wanted to grade flat slopes from the highway embankment into the new wetlands. But due to the soft soils in the area, known locally as “Bay mud,” CalTrans was concerned that any additional weight placed on the embankment could cause long-term settlement of the roadway. In order to keep the natural transitional slope design, Ducks Unlimited proposed using geofoam.
“Geofoam was not only the quickest solution for this project but the cost was on par with other options as well” said Russ Lowgren, an engineer with Ducks Unlimited on the project.

Fifteen thousand cubic yards of EPS 29 Geofoam was placed in the new embankment slope along the three-mile stretch of Highway 37. The geofoam was wrapped with a gasoline-resistant membrane to protect it from any petroleum spills and then covered with soil.

“We had never used geofoam before, so there was a learning curve, but overall, the project went smoothly,” said Scott Ghilotti of Maggiora & Ghilotti, Inc., the contractor for the project.

Geofoam has become a common material for constructing levees because the weight of soil can cause highly compressible underlying soils such as clays and silts to sink. As soil compression occurs, additional fill is needed to bring it back to grade, creating a continual cause and effect cycle, to ensure adequate flood protection. Geofoam adds minimal weight to the levee system and eliminates the need for future repairs.

**Rooftop pool**

Many pool users lounge on foam mats in pools, but in the case of the pool and hot tub at the Hub in Columbia, S.C., the pool rests on foam — geofoam that is.

Designing a pool on top of a building always presents challenges. Pools are heavy, and not just because of their water weight. The structure that supports them has significant weight. Engineers for the Hub had the added challenge of building on top of an existing parking structure that was not designed to support the weight of a pool. They depended on ACH Technologies’ geofoam to keep the weight down and make the pool as light as possible.

“Concrete would be too heavy for this project to work at all,” said Dan Ball, the principal of Genco Pools, which handled the pool installation.

Weight is such a problem for rooftop pools because of the variations in water depth. For in-ground pools, engineers create a 3D footprint of the pool that lines up with the shape and the depth of the pool. Less earth is removed for the shallow end of the pool and more is removed for the deeper sections. But for an above-ground pool, the shallow and deep ends are built on different foundation heights to match the pool’s profile. To support the shallow end, engineers must build the foundation upward. Concrete is often used to raise up shallow ends, but at the Hub, that would have been too heavy.

So instead of concrete, engineers used a variety of ACH Technologies’ geofoam, including EPS39, EPS22, and EPS15. The geofoam was light enough that it did not affect the parking structure, yet was strong enough to support the pool. The pool rested on varying thicknesses of geofoam ranging from 6 inches to 36 inches.

Geofoam offered many advantages to the engineers beyond its lightweight structural capacity. As a malleable material, the engineers were able to create curved, 3D geometry to match the pool and the hot tub’s designs. The speed of installing geofoam, compared with alternatives such as concrete, allowed the engineers to meet the short timeline for the pool’s installation.
While geofoam, with its high compressive strength, is often used in infrastructure projects, it was the perfect choice to support the pool at the Hub.

**Hospital parking garage**

A parking structure built to support the Primary Children’s Hospital Ambulatory Care Center at the University of Utah has five levels and can hold 1,400 cars. The challenge for designers was the top level, which needed to be able to hold up Salt Lake City’s largest fire trucks, cars, and extensive landscaping. Engineers needed a material that could absorb some of the stress caused by the weight of the automobiles and the landscaping. The material also couldn’t add much weight to the beams supporting the roof deck. ACH Technologies’ EPS46 Geofoam was the perfect solution. The high density of EPS46 Geofoam was well within the strength range needed to support the expected traffic loads. Engineers used more than 76,000 cubic feet of geofoam instead of concrete or soil, both of which would have been too heavy. By using a lightweight material to support the top level of the parking structure, engineers were able to increase overall loading capacity. This weight reduction also helped decrease the amount of structural support needed for the top floor.

“The geofoam achieved everything we wanted and expected,” said Mike Buehner, structural engineer and principal of Reavely Engineers in Salt Lake City, which handled the project.

**Underslab foundation**

Before construction could begin on the Deseret Mill & Pasta Plant in Kayesville, Utah, something had to be done about the soil. A site survey for the proposed pasta plant found the earth unusable. With a low bearing capacity, the soil wouldn’t be able to evenly support the plant and the manufacturing equipment, much of which had been imported from Italy.

Excavating the dirt, refilling the site, and waiting for the soil to settle would have been expensive and time consuming. The process would have taken six to nine months for the soil to resettle, become even, and gain the necessary compressive strength to support the 44,200-square-foot plant. That was more time than the construction schedule would allow.

Creating an even, strong pitch to build the factory on was easy and quick when the geofoam was incorporated. There was no wait time for the geofoam to settle and the project was able to proceed on schedule.

“Time was the motivating factor [for us to use geofoam],” Peterson said. “It worked really well. There was no delay.”

**Insulation and grade support**

Resolving significant grade changes on a building site can be a costly and time consuming endeavor. Engineers working on the Wisconsin Vision Associates warehouse in Burlington, Wis., turned to an unexpected solution — ACH Foam Technologies’ geofoam. With a grade change of more than 17 feet on the projected building site, the engineering team faced the prospect of removing a substantial volume of earth and then having to support the remaining mass with a costly and time consuming 18- to 24-inch-thick retaining wall. Instead, engineers turned to geofoam. In three days, contractors installed 472 cubic yards of ACH Technologies’ EPS12 Geofoam, solving the problem and putting the project ahead of schedule.

“It was very easy — I didn’t have to design anything special. I just used a regular wall next to the foam,” said David Kampe, the structural engineer who worked on the project.

Information provided by ACH Foam Technologies (http://achfoam.com).
01. HOLOGRAPHIC TOOLS DEVELOPMENT
Trimble is working with Microsoft to develop a new generation of tools, integrated with the HoloLens holographic platform on Windows 10, which are intended to improve quality, collaboration, and efficiency in the design, construction, and operation of buildings and structures. Trimble’s initial research is focused on the integration of HoloLens with Trimble Connect, which enables teams to access and manage project data via a cloud platform; SketchUp, a 3D modeling platform; and Trimble V10 Imaging Rover, an integrated camera system that captures 360-degree digital panoramas that can be transformed into data-rich geospatial deliverables.

02. CONCRETE, MASONRY SCREW ANCHOR
Simpson Strong-Tie now offers its Titen HD screw anchor for concrete and masonry in 1/4-inch diameter. According to the company, the self-undercutting, non-expansion characteristics of the Titen HD anchor make it ideal for structural applications. It is recommended for permanent applications in dry, interior, non-corrosive environments or temporary outdoor applications. Classified as a Category 1 anchor, it is code-listed under the current IBC/IRC in accordance with AC193 for cracked concrete applications per ICC-ES ESR-2713 and with AC106 for masonry applications per ICC-ES ESR-1056.

03. STORMWATER, SEPTIC CHAMBER WEBSITE
CULTEC, Inc.’s redesigned website — www.cultec.com — provides a company history and detailed information, downloads, and images for the company’s lines of stormwater management and septic products. Tabs help users navigate the site and access informational downloads, customer support information, and product details. A “Downloads” tab is divided into three sections — stormwater systems, septic systems, and additional downloads — each of which expands to offer design tools, CAD and PDF technical drawings, literature, chamber specifics, information about accessories, and more.

04. MAPPING AND INSPECTION DRONE
senseFly launched the eXom quadcopter UAS for mapping and inspection. eXom’s autopilot-controlled TripleView camera head enables users to view and record three types of imagery during a single flight without landing to change cameras — HD video, ultra high-resolution stills, and thermal still/video. The TripleView head faces forward, so eXom can fly close to target structures such as building walls and dams to achieve sub-millimeter data resolutions, senseFly said. Plus, the head’s 270° vertical field of view allows users to document objects positioned directly above and below the drone.

05. TENSION FABRIC BUS GARAGE
Legacy Building Solutions designed, manufactured, and installed a tension fabric structure for the City of Davenport, Iowa’s new bus storage facility. The building features a fire-rated, 15-ounce fabric roof attached to a solid steel frame. It measures 300 feet by 70 feet, with a peak height of 31 feet, 4 inches, and can hold approximately 25 buses. Each endwall features three doors — two 16 feet wide by 13.5 feet tall, and one 20 feet wide by 13.5 feet tall. A portion of the roof at the peak provides a fabric skylight area.

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Civil + Structural Design Tools

STRUCTURAL STEEL DETAILING

By Bob Drake

Advance Steel 2016 users can update a model with the current status information from fabrication to shipping.

ISO standards-compliant weld symbols are displayed automatically on drawings.

AUTODESK ADVANCE STEEL 2016 software, previewed in March at NASCC: The Steel Conference, provides structural steel detailers, fabricators, and engineers with 3D modeling tools that support a building information modeling (BIM) process. According to Autodesk, this helps accelerate more accurate detailing of structural elements, steel connections, and plates. In addition, Advance Steel 2016 helps speed time to fabrication by automatically generating shop and general arrangement drawings, creating bills of materials, and producing CNC files directly from designs.

With interoperability between BIM software, such as Autodesk Revit and Autodesk Navisworks, Advance Steel 2016 also provides a way to connect BIM-based design and construction through fabrication.

“Following the introduction of Autodesk Advance Steel 2014, we received a lot of great feedback and suggestions from users worldwide,” said Heiko Graf, Autodesk senior product line manager. The new 2016 release incorporates the top most requested enhancements resulting in performance, weld definition, and interoperability improvements, to name just a few.”

KEY CUSTOMER-DRIVEN ENHANCEMENTS FOR ADVANCE STEEL 2016 INCLUDE:

- Steel modeling: Scalability and performance improvements — Helps to navigate more efficiently in a model by quickly isolating selected elements in a work area to be displayed in the current visual style, while the other elements get a much lower level of detail (beams axis shown only). This enhanced feature helps improve performance when working with complex models.

- Steel modeling: Weld definition properties enhanced — Representing specific weld characteristics in a DWG file used for fabrication can be a time-consuming, tedious task. Enhancements now help users define weld properties directly [e.g. effective throat or root opening], or opt to have them set automatically when using the automatic steel connections feature. The resulting ISO standards-compliant weld symbols are displayed automatically on drawings; and specific preferences may then be easily adjusted in the DWG file.

- Interoperability: Status tracking information — Helps to easily round-trip model information with MIS software thanks to a bidirectional link. This enables the updating of a model with the current status information from fabrication to shipping. Elements can then be colorized in the 3D model based on the updated status. These features help facilitate an integrated steel fabrication management process.

“One of the areas where we are very excited about Advance Steel is to be able to address some of these crucial issues for owners in a common environment where they can communicate together,” said Will Ikerd, IKERD Consulting. “The models for the exterior skin can be interacted and communicated with for the structural steel.”

Information provided by Autodesk (www.autodesk.com).
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